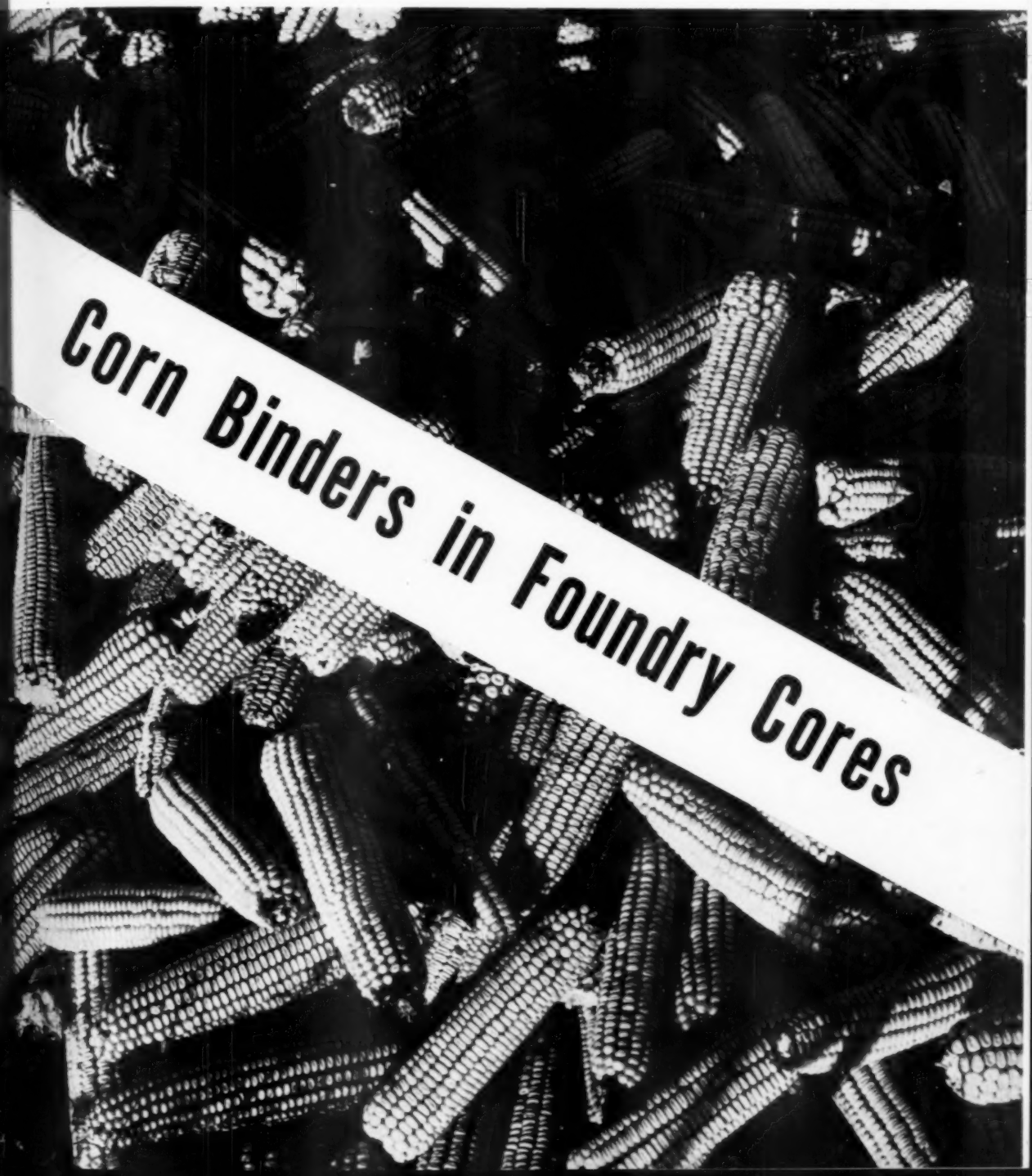
Need #1 Hold Dennis Lee
Eric

ADHESIVES AGE

MANUFACTURE, APPLICATION, TECHNOLOGY, RESEARCH AND MARKETING

JUNE, 1960

SCIENCE



Corn Binders in Foundry Cores

Shawinigan's GELVA Powders 700 and 702

GELVA Powders 700 and 702 are Shawinigan Resins' PVAc emulsions **with the water removed.** Now adhesives manufacturers can formulate for the exact amount of solids required, or use PVAc in an entirely dry form . . . and always be sure of the same high quality that distinguishes Shawinigan Resins' GELVA emulsions.

GELVA Powder 700, noted for its easy-to-handle qualities, may be combined with such ingredients as starch, clay, wood flour and silica for use in a wide variety of dry mix adhesives. When GELVA Powder 700 is mixed with dry thermosetting resins, the adhesive formulation achieves a new standard of toughness, flexibility, and resistance to blocking. GELVA Powder 700 has long-term stability and will not affect the shelf life of your adhesives. As an additive in such materials as concrete, it increases the cohesive strength, flexibility and resiliency.

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Actual photograph of prototype manned capsule containing the STAFOAM cushioned space couch coated with STABOND HYPALON T-200. Capsule is a major element of maneuverable satellite for rendezvous in space, under development by the Astro Systems Research Laboratories, Norair, Division of Northrop Corp.

The Freedlander Research and Development Laboratories at Hawthorne, California are available to research and provide exacting information for new STABOND applications

Space destined man and his equipment is protected by the thoroughness of research and resulting materials. Materials such as STABOND *Hypalon* coatings guard his oxygen hose, pressure suit and attending components against the wrath of ozone, weather and abrasion. His safety is further assured by STABOND *Hypalon* fire extinguishing coatings over fuel cell insulation. *Today*, more and more practical applications are being discovered for the miracle STABOND coatings, adhesives and sealants to protect the man and his equipment.

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- Rubber products
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- Instrument boots
- Outdoor electric conduit
- Metal storage tanks
- Marine & industrial cable
- Exposed components
- Arctic clothing & equip.
- Fuel tank lining
- Exposed structures
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ADHESIVES AGE

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About the Cover Photograph

This month's cover serves to introduce our lead article on the use of "Corn Binders in Foundry Cores." It was found that a switch from oil sand cores to corn not only improved core properties, but eliminated the frequent cleaning of core boxes, the clogging of core blowing vents and periodic cleaning of arbors. The cover photo is used courtesy of Standard Oil Co. (N.J.).

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PALMERTON PUBLISHING CO., INC.

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Indexed in Industrial Arts Index and Engineering Index.
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10,600 Copies of This Issue Printed

ADHESIVE AGE is published monthly by the Palmerton Publishing Co., Inc. Printing Office, Bristol, Conn. Editorial and Advertising Office at 101 West 31st Street, New York 1, N.Y. Subscription in the United States, $5.00 a year; Canada, $5.50; Foreign, $6.00; Single Copy, 50¢. June, 1960. Volume 3, Number 6.

what is GRAM?

To the animal glue manufacturer, buyer or user, "*gram*" doesn't mean HOW MUCH. It means HOW STRONG.

It's a measurement of GEL STRENGTH which in turn is an indication of adhesive properties.

In the old days, the strength of a glue was judged by poking a finger into a chilled glue gel. The degree of resistance determined the grade.

Today, modern laboratory apparatus replaces the "finger poking" technique and accurately measures gel strength in terms of weight in grams.

Also, better *production* techniques are now yielding much higher gel strength bone glues.

Within the extended range of grades offered by Darling & Co.—

one of these 8 should do your job most economically

GREEN STRIPE.....196-220 grams
ORANGE STRIPE.....171-195 gra
ORANGE STRIPE.....146-170 gra
RED STRIPE.....121-145 gra
RED STRIPE.....101-120 gra
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improved BONE
GLUE

News about R&A SINCE 1913 **Adhesives**

FOR ALL METALS AND ALL PLASTICS

New "quick-grab", soft seam adhesives for flexible plastic foams

- *Yield bonds of "tearing strength"*
- *Set rapidly for swifter mass production*
- *Brush smoothly for lower labor costs*
- *Travel further for lower cost-per-unit*

While there is no "universal" adhesive for every type of application, our new BONDMASTER® R275 appears to be "the" answer for foam-to-foam bonding.

This new adhesive features as soft and dimple-free a seam as you've ever seen, and a "tearing bond" on all brands of flexible urethane and rubber latex foams.

What's more, current users report these added time-labor-and-cost-saving benefits: "It grabs faster – we can turn over the cushion sooner without it falling apart" . . . "It seems to coat without penetrating – we use less" . . . "It doesn't run off the brushes – cleaner to work with".

Mass-production bonding of urethane foam to carpeting demands a quick-drying, flexible, non-staining, machinable adhesive.

FOAMS TO FABRIC, WOOD, METAL

For foam to fabric, to wood, to metal, to carpeting, to you-name-it, we've a wide range of other "chemical fasteners" developed for specific applications.

BONDMASTER R328T seems to be the favorite for bonding urethane foam to fabric or to wood. BONDMASTER G527 is specified for sound-deadening foams by a leading equipment manufacturer. Our R203 features extremely fast drying solvents for instantaneous bonding of fabric reinforcing tape to foam seats in automotive mass production.

We've a non-staining adhesive for vinyl foams – BONDMASTER R294 – that withstands drycleaning in Stoddard and other naphtha cleaning solvents.

And, of course, the first practical rapid-tack-loss, one-part, fast-grab soft-seam adhesive for foam rubber – BONDMASTER R225, developed by R&A in 1947 – is still the leading formulation used in that industry.

Tell us about your specific problems so we can send samples of the adhesives most efficient for the materials you are working with.

Part of the problem is that they're so versatile . . .

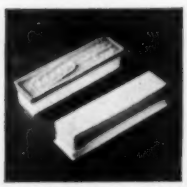
. . . flexible urethane and vinyl foams, we mean.

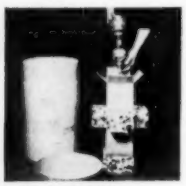
They're being used in so many different products in so many different ways . . .

And must withstand so many different types of service conditions in end-use . . .

. . . that a "universal" adhesive just "cannot be". (Some bonds must be flexible, others rigid, for example.)

For instance . . .





Urethane foam to itself . . . to foam rubber . . . to wood . . . to rigid styrene . . . to cardboard . . .

You can, however, have one single source of supply if they are equipped to serve you with "families" of adhesives, custom-tailored to each specific type of end-use. As were the BONDMASTER adhesives used in the products shown on this page!

R&A SINCE 1913

RUBBER & ASBESTOS CORPORATION

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BLOOMFIELD, NEW JERSEY

Published Monthly by
PALMERTON PUBLISHING CO., INC.
Editorial and Advertising Offices
101 West 31st St., New York 1, N. Y.
Phone: PEnnsylvania 6-6872

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EDITORIAL

As If We Didn't Have Enough Problems!

Editors returning from staff assignments about the country report on a significant development which is taking place in all industry and which, in effect, is creating increasing difficulties for adhesives consumers. An ever-growing number of manufacturers of a wide variety of end-items are turning to overseas sources for machinery and equipment. Textile people, paper people, leather goods people and others are acquiring foreign-built and foreign-designed equipment. Often, the very nature of the foreign equipment causes some difficulties when adhesives become involved.

A typical case would go something like this: An envelope manufacturer had been using a certain type of domestic machine for his production. The application of the glue to the envelope flaps required certain chemical and physical considerations. He has now acquired a new piece of foreign equipment and has found, to his consternation, that the design of the foreign-built machine dictates a change in his glue formulation.

Situations such as this can be multiplied many times. So here we have a problem involving the adhesives consumer. Ultimately, the adhesives manufacturer is confronted with the same problem. The producer of machinery involving adhesives applications also finds himself involved from still another angle. The manufacturer of adhesives bonded end-items who is considering the purchase of foreign machinery and equipment should bear in mind all factors devolving upon the use of his new equipment. Are his adhesive formulations suited to the new unit? Is a closer liaison between consumer and adhesives manufacturer indicated?

In the broad sense, most companies and individuals are becoming increasingly aware of the inroads which foreign imports are making in domestic markets. Many, however, are less aware of the concurrent problems which are cropping up.

We do not wish, at this point, to become involved in any discussion of free trade, tariffs, etc. We do wish to suggest, however, that the adhesives consumer, manufacturer and equipment manufacturer re-examine their positions in the light of the adhesives problems involved. Today's bargain may well be tomorrow's red ink.

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Whether your "joining" operations call for standard adhesives, or something entirely new and different... Call DURAL *First* on both counts.

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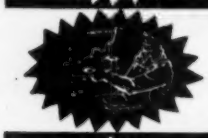
Forming of parts, holding fixtures, casting forms, electrical connector potting, concrete floor repairs



COATING
Trowellable for sealing cracks in walls, concrete pipe, gelcoating of molds and patterns, gloss coating, sheet metal bonding and sealing

LAMINATING
Glass cloth lamination, impregnation of felt and concrete, reinforcement of glass for sheet metal repair, fabrication of ductwork, chemical storage tank lining

FILLING
Aluminum or steel paste for metal repair, sealing of seams, wire rope terminal potting, bonding metal to metal, body work, mounting bolt grouting, filling porous castings

Furane formulates epoxies for these and many other uses. Contact us for specific information concerning your particular application.

furane plastics, INCORPORATED
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CHapman 5-1153 Dept. AA

CONSULTANT'S CORNER

By Dr. Irving Skeist

Bonding Inked Surface

Question: Our firm manufactures set-up paper boxes and uses hot animal glue exclusively. At present we are faced with an adhesive problem on a particular large volume order. The cover wrap in this case is printed in a solid color and the ink manufacturer has used a polyethylene wax base in his ink. Since this box is hinged at one end, it is necessary that the glued surface of one flap adhere to the solid ink surface.

We are not getting the proper adhesion to the ink surface without first breaking down the ink by rubbing it with a diacetone solution. We would like the name of a non-toxic additive which could be mixed with our glue to give it the heat and penetration necessary.

Answer: Your simplest solution would be to induce the printer or ink manufacturer to switch to a nitrocellulose or vinyl base ink

If this is not expedient, you may try incorporating a chlorinated solvent, for example 10 per cent trichloroethylene plus ½ per cent of a surface active agent such as Union Carbide's Tergitol 7 to assist in blending it with the glue. Trichlorethylene is toxic and necessitates adequate ventilation at the machine. However, the toxicity apparently does not carry over to the consumer, as solvents of this type are often included in adhesives which must "cut" wax coatings.

Q-135

Zinc Oxide in Adhesives

Question: Can you give me some information as to the stability of a water-base contact bond? Does this type of adhesive require the use of zinc oxide?

Answer In adhesives based on neoprene, zinc oxide is desirable to neutralize the hydrochloric acid that may be liberated upon aging. Otherwise, zinc oxide is not generally required in *water*-base contact adhesives. Zinc oxide is often incorporated in *solvent*-base rubber adhesives as a filler and pigment, to combine with the acid groups in rosin, and to help vulcanize rubbers.

Q-147

CONSULTANT'S CORNER

Leather to Cast Iron

Question: At our pottery plant, we have been having difficulty bonding leather to a machined casting (cast iron). This casting is in the form of a 30" diameter wheel on the outer face of which is bonded a heavy leather belt. This belt serves as the friction face which makes and breaks the contact with a circular drive disc.

Do you have any suggestions as to a suitable adhesive? We prefer to do the bonding cold.

Answer: A liquid epoxy resin can be hardened with an aliphatic amine curing agent without applying heat from the outside. If the glue line is thin, wait at least a day after bonding before applying stress.

Q-149

Wood to Varnish

Question: We are manufacturers of built-in storage components and have recently run into a problem of adhering narrow strips of white hard maple (½" wide, ¾" thick), to a door front which has been finished with DuPont Dulux catalyzed varnish. The surface being glued to the varnish is not finished and is plain wood. We would be pleased to have some advice on the best type of adhesive to form this bond.

Answer: Many adhesives are suitable for the wood. The varnish may be bondable with a nitrile rubber-phenolic solvent cement. Coat both adherends and let the solvent evaporate before bringing the surfaces together.

Q-152

Binder for Perlite, cont.

The December 1959 issue of ADHESIVES AGE carried an item (Q-123) requesting information about an adhesive that might be used to form a soil cube consisting of peatmoss, perlite and topsoil. John H. Wills adds the following suggestion to those given in the original column.

"An adhesive often used with perlite is sodium or potassium silicate. This will give as strong a bond as is likely to be required and can be made as slowly soluble as desired. Potassium silicate and even sodium silicate have often been added to soils to develop better soil structure and also have been included in fertilizers for the same purpose. They are also used to facilitate the use of phosphate."

Readers who would like to contribute their own experience with problems similar to those discussed in Dr. Skeist's column are invited to write to ADHESIVES AGE, *101 West 31st Street, New York 1, New York. Please refer to the code number given at the end of each question and answer group.*

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Like putting mittens on kittens, you can protect polished finishes on aluminum, stainless steel, plastics, glass . . . metals and materials of all kinds . . . This self-stik "skin" applies quickly from the roll—provides a tough, scratch-proof covering during all processing, fabricating, handling, shipping, storage. Write today for information and samples.

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new adhesives

AND ADHESIVE PRODUCTS

Corrosion-Resistant Tape

X-Tru-Tape is a new, corrosion-resistant tape designed for wrapping joints of plastic-coated steel pipe, and also serves to protect exposed ends of plastic pipe, which is supplied from

the mill "cut-back" to allow welding. The plastic tape is resistant to moisture, acids, alkalies, salt, stray currents and corrosive environments to which a pipeline is often subject, the manufacturer states. The tape is colored opaque yellow to reflect heat and make the pipeline immediately noticeable to workmen in areas under consrtuction. It offers an insulation value of more than 500,000 megohms and has a dielectric strength to 15,000 volts. X-Tru-Tape comes in one, two and four inch widths in 100 foot rolls and consists of a ten mil (0.010 inches) backing of polyethylene plastic and four mils of special synthetic adhesive. *Republic Steel Corp.* **P-312**

Photo Adhesive

Complicated tissue dry-mounting of photos can now be replaced by a method that uses an aerosol spray adhesive which is said to remain transparent, flexible and water-proof indefinitely. Spray-Mount bonds to glass, paper, leather, wood or metal. Spray-coated material can be mounted with an ordinary hot iron set at "rayon," or in a dry mounting press set at no more than 220°F. The moderate heat-setting temperature of the adhesive is said to make it ideal for mounting color prints. Cured bonds are unaffected by heat or humidity, and they can be bent or flexed without causing separation. *Strauss Photo Technical Service, Inc.* **P-313**

Seal-Coat-Caulk Trio

Three new adhesive products that seal, coat and caulk roof gutters, downspouts, metal flashing and similar installations are announced. Pliogrip 12-1 is a sealant that protects against corrosion and deterioration by water, acids and chemicals. It sets almost immediately after application and will adhere to most surfaces. The protective coating, Pliogrip 12-2 is applied by brush to gutters, metal flashings, etc. and forms a crack- and abrasion-resistant coating which holds up against the action of oils, chemicals and organic acids. Pliogrip 12-3 is a filler or caulking compound for storm door and window frames. It is a paste-like material that sets quickly, adhering to metals, ceramics and wood. *Goodyear Tire & Rubber Co.* **P-314**

Glass Cement

Sun-Seal is a new glass cement that enables the building of permanent constructions of glass without the use of any metal clamps, strips, or mastics. The manufacturer reports that Sun-Seal has excellent binding strength, as well as resistance to rain and weather, making it suitable for use in outdoor display cases in addition to show-case and glass structures of every kind. Sun-Seal comes in two separate types of cement: SH-1 for air-drying; and SH-2 for bake-setting in over 80°F. It is insoluble in water and has elasticity. It will not crack, chip or peel. Sun-Seal is applied with a spatula. *Sash-Seal Co.* **P-315**

Rez-N-Glue Clear Adhesive

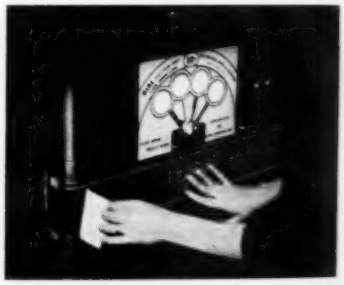
Rez-N-Glue No. 378 is reported to be particularly suited for general purpose applications, including the bonding of fabric, paper, wood, plastic, glass, metals and many other materials. It is a new clear pressure-sensitive adhesive supplied with heavy syrup viscosity for fast drying application with brush roller or doctor knife. It remains soft and can be used within a few minutes or covered with release paper for deferred use. The glue has a natural rubber base. *Schwartz Chemical Co., Inc.* **P-316**

Epoxy Repair Compound

Having good tensile and compressive strength, Devcon 100, a putty-like material, and Devcon 101, a liquid, resist most chemicals and oils, and will bond to all types of metals, wood, ceramics and other materials. The manufacturer recommends their use for repairing damaged machinery, foundry patterns and core boxes, and for other applications where high strength and light weight are important factors. They also can be used, either as a core material or by themselves, for making patterns, dies, core boxes, holding fixtures, and other tools. Devcon 100 and 101 come in gallons, 5 gallons, and drum quantities, and each unit is packed complete with exact amount of hardening agent, sufficient release agent, and instructions. *Devcon Corp.* **P-317**

Self-Adhesive Metalized Plastic

Self-adhesive metallized Mylar-vinyl laminate materials are available for many metal trim applications.



They are available in rolls, strips and sheets and can be further processed by die-cutting, silk screening and hot stamping. Finished materials can be applied by simply removing the backing paper and pressing into position. *Fasson Products* **P-318**

Epoxy Flooring Compound

E-Bond #1005 is an epoxy-based compound that welds itself to concrete flooring or any masonry surface and is said to provide a bond with four times the abrasion resistance of concrete. It can be applied to old or new concrete, wood, ferrous and non-ferrous metal, and virtually any firm surface, states the manufacturer.

A wide range of colors can be used to pigment the compound which trowels to a minimum of 1/16 to 1/4 of an inch and can be feather-edged. Non-skid properties can be increased by adding carborundum or aluminum oxide to the mix. *International Epoxy Corp.* **P-319**

New Vinyl-Acrylic

COPOLYMER SOLUTION

Another example of original resin research at National's Plainfield, N. J. laboratories. Built in 1952. Doubled in 1955. Expanded in 1957. With major expansion recently completed.

FOR FLEXIBLE AND PRESSURE SENSITIVE ADHESIVE COATINGS

A new, unique copolymer solution. Ideal for flexible film laminations and pressure sensitive adhesive formulations. Exhibits specific adhesion to most cellulosic and synthetic surfaces.

Application possibilities for this tacky, flexible film former are many. In laminations of "Mylar"* polyester film, cellophane, nylon, polyethylene, saran, paper, foil. In packaging adhesives. In pressure sensitive and specialty adhesives. In printing inks.

This new base is noncorrosive. Exhibits excellent heat and light stability. It can be used as is or modified to accentuate specific characteristics. Technical data and information on compatibility with other film formers, resins, tackifiers and solvents are available. Formulated grades are also offered. For details contact your nearest National office.

*Du Pont's reg. trademark.

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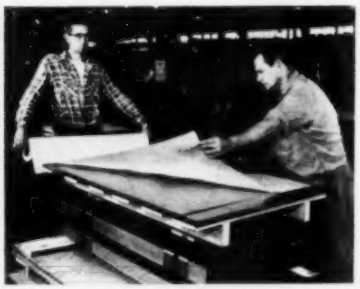
Pressure-Sensitive Paper

Finished surfaces can be protected with KB pressure-sensitive papers which are available in roll form. KB1 is non-stretchable; KB2 is a



resilient stretchable covering that has a latex adhesive. The papers are smoothed on without wrinkling or bubbling and leave no strain or blemishes when removed. The papers can be temporarily replaced without any harm to their protective or adhesive qualities; the white surfaces can be written on. Odd sizes and pre-printed papers are available on order. *Tech-Industro Co.* **P-320**

Silicone Rubber Tape

A glass cloth coated with silicone rubber, ES 5111 Silicone Tape is used to give armor tape protection when winding motor coils for low or high voltage units. By using ES 5111 coils for rotating machinery, users are provided with a void-free envelope without resorting to combinations of heat and pressure, the manufacturer claims. When used with the manufacturer's PSR 2800 Triangular Guide Line Tape it produces a tough silicone insulation envelope. A unique feature of ES 5111 is that one side of the tape is fully cured while the other side is uncured. According to the manufacturer this permits an unusually stable and long shelf life. *Permacel.* **P-321**

Epoxy Surface Coat

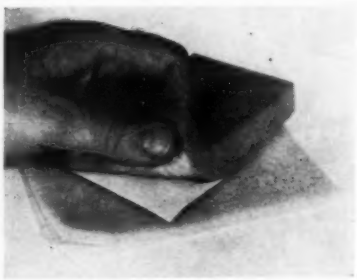
Application of Ren RP-1125 Surface Coat can be with either putty knife, spatula, paddle or brush; it can be layed on paper-thin or built up to ⅛ of an inch. Glass cloth can be pushed through the material right out to the surface, yet the coat will hold the cloth away from the surface at any selected thickness for other applications. The new material eliminates the need for waiting for the tack stage; laminating may be started immediately. *Ren Plastics, Inc.* **P-322**

Fluoroetch Solution

Fluorocarbon polymers can be made bondable to other materials by treating them with Acton Fluoroetch Solution, an activated form of sodium in solution. The product reacts with the fluorocarbon resin, extracting fluorine atoms at the surface with the formation of a carbonaceous film which is said to be compatible with most adhesives. To use, the polymer surface is first cleaned with an industrial solvent such as acetone and allowed to dry. Next, areas which are not to be treated are masked off with tape and the areas to be bonded are treated by dipping, spraying, brushing or spotting. The etching solution should be in contact with the polymer surface for 15-60 seconds. *Acton Laboratories.* **P-323**

Self-Adhesive Polyurethane

Self-adhesive polyurethane foam in sheet form is available in graduated sizes from ⅛ to four inches in thickness. It will bond to either



smooth or porous surfaces. The self-adhesive backing has a long-lived bond which becomes more permanent with time, states the manufacturer. *Morgan Adhesives Co.* **P-324**

One-Part Epoxy

Because it is thixotropic, Metabond 321 can be applied to vertical surfaces without any running or sagging. The one-part, high-temperature epoxy requires short heat curing to form a strong bond. Stable at 200°C., or even higher in some cases, the adhesive bonds to metals, ceramics, glass, cement and other temperature-stable materials. It has a shelf life of over one year if kept below room temperature. Application is by spatula. Glue lines from one to ten mils are satisfactory. Contact pressure is suitable in most cases. *Metachem Resins Corp.* **P-325**

Film Adhesives

Four newly announced Scotch-Weld elastomer-phenolic film adhesives are said to exceed military specification MIL-A-5090B for structural bonding and honeycomb sandwich construction. AF-10 is designed for use at service temperatures ranging from −70° to 180°F. AF-30 is designed for use at temperatures ranging from −67° to 300°F. AF-31 offers maximum elevated temperature strength as well as good flexibility, peel strength and low temperature properties. AF-32 is formulated to combine good flexibility and high shear strengths with exceptional peel strength at service temperatures ranging from −67° to 300°F. With all four types, maximum strength is obtained with an optimum cure of one hour at 350°F. under 100 psi pressure. However, high bond strength in excess of 250 psi tensile shear strength can be obtained with a cure time as low as three minutes at temperatures in the 400° to 450°F. range. *Minnesota Mining & Mfg. Co.* **P-326**

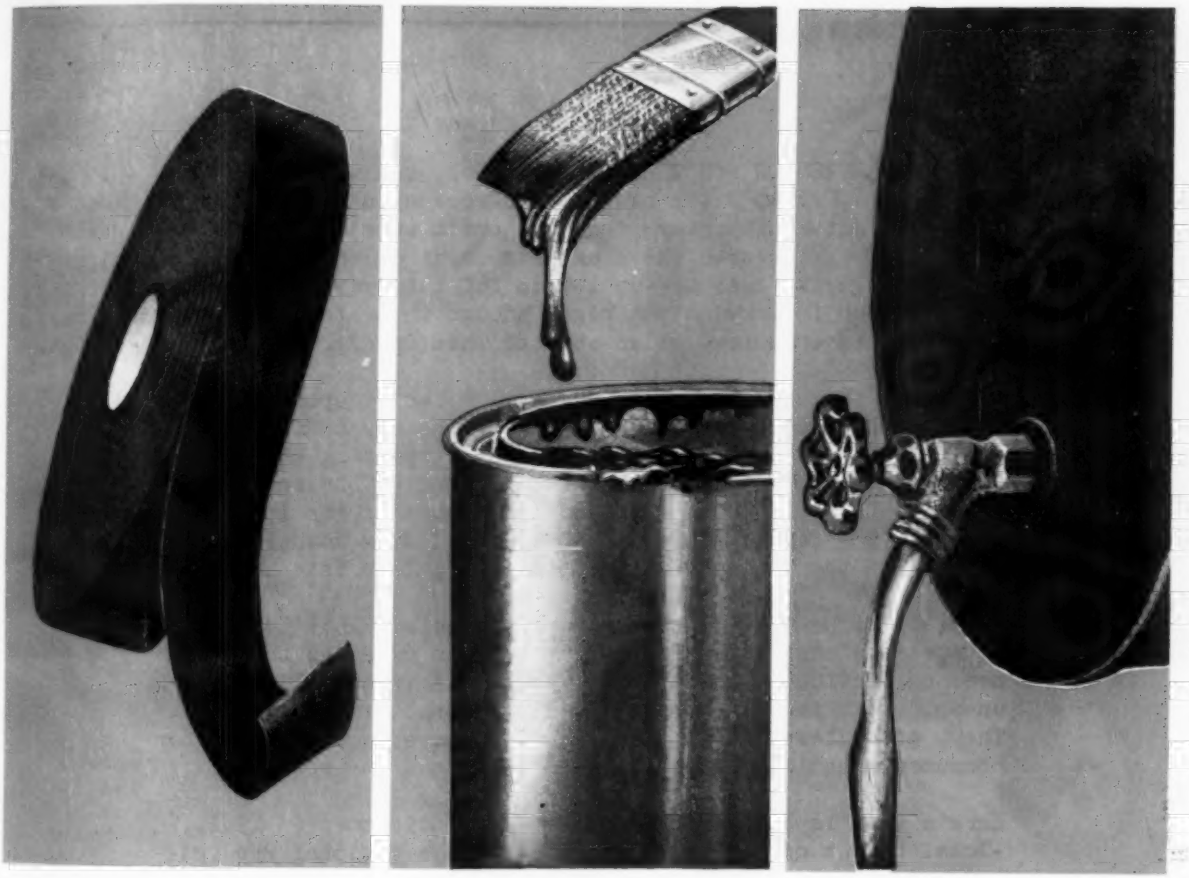
Melamine Glue

A white, practically-odorless powder, M-3 is a melamine glue which produces a waterproof bond for plywood and edge-glued lumber. It contains no fillers or catalyst. Because heat is required to set the glue line, hot press and high frequency gluing are recommended. The light-colored glue lines produced meet the requirements of MIL-A-397B, CS-35-56 and other government specifications for waterproof plywood. M-3 can also be used with liquid and powdered urea resin glues to upgrade bond durability. Used as a urea resin glue fortifier, it enables wood manufacturers to meet glue bond requirements of CS-35-65, Technical and Type I grades. *National Casein Co.* **P-327**

Contact Adhesive

Both spray and machine roller-coating application can be used with Bostik 206-281, a contact adhesive with a fast solvent release that is said to make it particularly suited to production line panel assembly of particle board, plywood or metal materials. The adhesive has excellent heat resistance up to 180°F. A reddish tint aids users who employ spray application by providing a visual check on spray control. Best bonds are obtained with both heat and pressure. *B.B. Chemical Co.* **P-328**

Naugatuck RECLAIM



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capitol cues

THE NEXT RECESSION WON'T HIT BEFORE 1961, and when it does it will be moderate and short. That's the nearly unanimous opinion of the government's top economists. Put another way, they are optimistic about business until the early part of next year. These experts count on spending for new plant capacity to keep rising smartly--up 14% to 16% this year. Inventory building is expected to keep factory output high, though the rate of accumulation may slow. And consumer spending, which spurted this Spring, will also stay high.

For 1961, the analysts don't see how we can escape a slide. A reversal of current favorable factors next year is the big reason behind this conclusion. Business spending--for new capacity and for inventory--will turn down. Consumers aren't expected to keep buying cars and appliances at the 1960 rate. Finally, the federal Budget will begin to show considerable black ink; the Treasury will be taking in less than it spends.

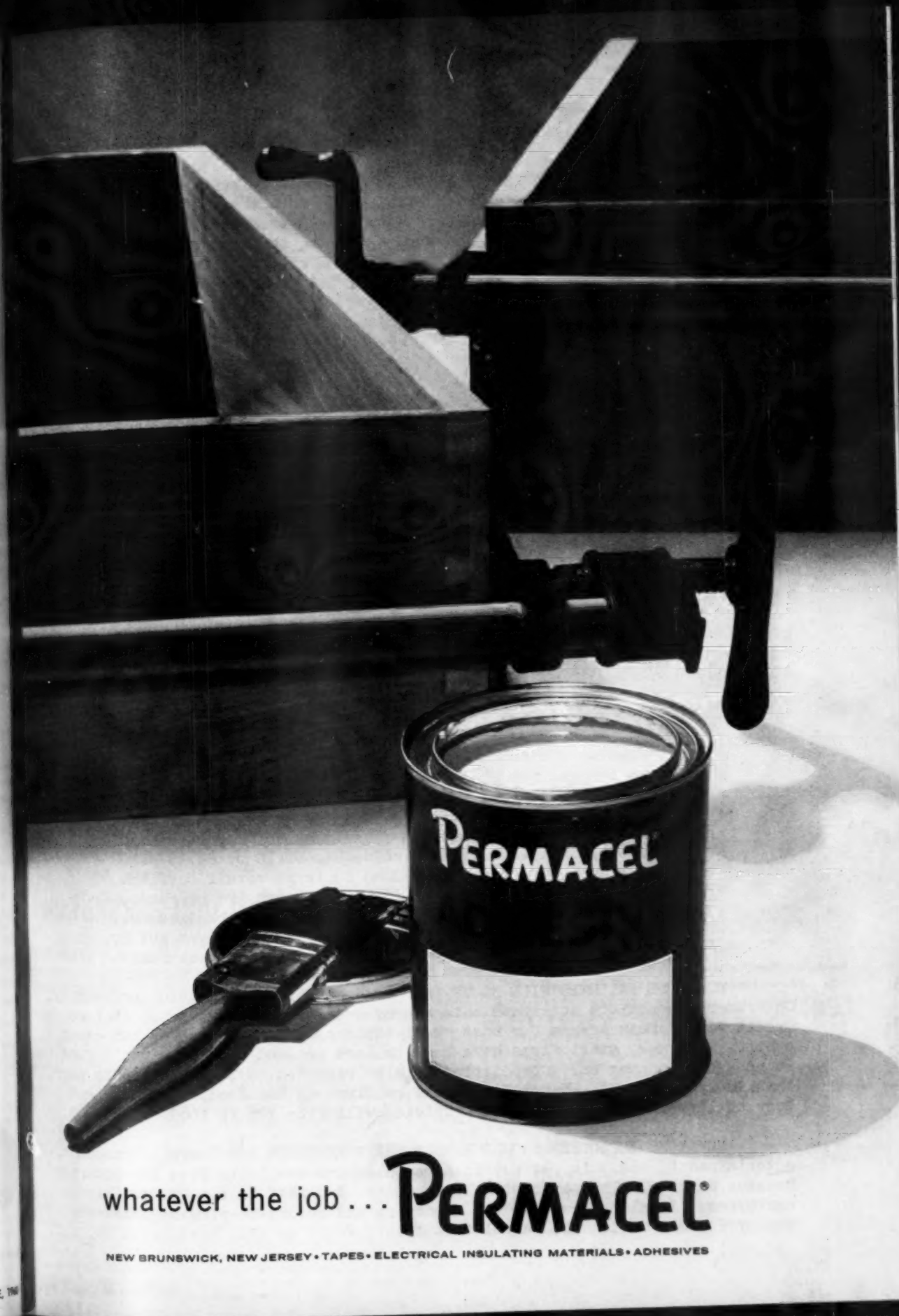
The 1961 slide will be mild, like 1953-54 and 1957-58. Why? Because business isn't racking up serious excesses that will need correction. What's more, the "built in stabilizers"--unemployment insurance, etc.--will be cushioning the impact. Then, after less than a year, housing, investment, and higher consumer spending will begin to bring about the recovery.

Here's what is likely to happen to key indicators in 1961:
-Total output of goods and services--Gross National Product--will drop only 3-5% from the $520 billion rate at year-end.
-Industrial production will fall sharply--perhaps 10% or so.
-Personal income will decline only 1% or 2%, as unemployment insurance, social security, and other benefits ease the dip.

CONSUMER PRICES MAY RISE MORE THAN WAS EXPECTED at the start of the year, government experts are predicting. Rising food prices are the reason for this new outlook--meat and vegetables, especially. For the first time in two years, food prices will be reinforcing increases in rents, services, etc. Up to now, food has been an offsetting factor, holding the Indexes down. By year-end, Consumer Prices may reach 128% of the 1947-49 base--not the 127% that was forecast earlier. The recent level has been 125.7%.

This rising trend in prices doesn't foreshadow a new round of inflation. For one thing, the food increases are flukes, the result mainly of bad weather which hurt crops and held up marketings. And wage hikes won't be any greater than in the past year. Nonfood prices will be rising only a little.

THE OUTLOOK FOR EXPORTS IS ONE OF THE BRIGHT SPOTS in the business picture. Shipments abroad in the first quarter topped those of a year ago by 21%. High-level industrial activity abroad is creating heavy demand for U.S. goods. And their prices are proving to be quite competitive. What's more, government programs have proven helpful in financing foreign sales.



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capitol cues (cont'd)

CORPORATE PROFITS AREN'T RUNNING AS STRONG as forecast at the start of this year, a survey of first-quarter earnings of more than 500 corporations shows. The increase so far this year is only 7% over a year ago, compared to estimates of 15% or 20% made in January. And with the economy leveling, the quarterly gains for the rest of the year will be smaller. So 1960 profits may be $50 billion, not the $54 billion expected; they reached $48 billion in '59.

Here's why corporate profits are running behind forecasts:
-Costs are rising faster than productivity--a switch in trend.
-Output is being cut in durables only partly offset elsewhere.

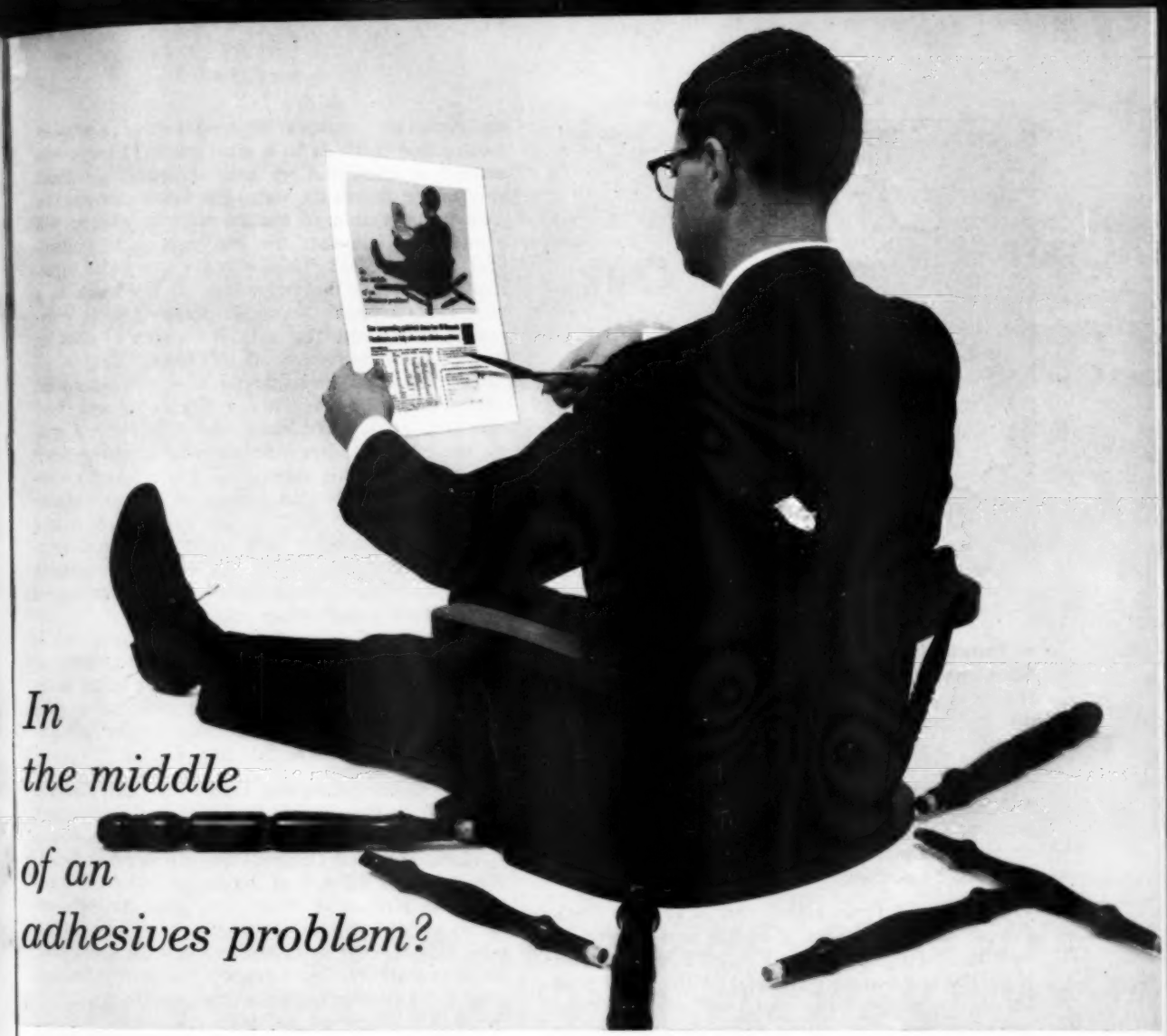
Here's how first-quarter 1960 net compares with early 1959:
-Largest increases were registered in machinery (up 25%), stone, clay and glass (17%), office equipment (12%), steel (12%), drugs (11%), finance (10%), chemicals (10%), and foods (about 10%).
-Smaller gains came in electrical equipment (9%), utilities (9%), autos (9%), paper (8%), oil (6%), car parts (4%), and coal (3%).
-Declines showed up in nonrail transport (down 95%), nonferrous metals (16%), building material (15%), rubber (10%), rails (2%).

CONGRESS FACES A LOGJAM OF LEGISLATION in the remaining weeks of this session as a result of time lost in the long fight over civil rights. Only the most essential bills will get through, and those will be in line with the moderate philosophy of the top Democratic leadership in both Houses. Threats of vetoes will be strong enough to head off big spending measures, too. The bills killed generally will be those to which businessmen have been opposed.

On the issues still pending, here's what Congress will do:
-The Budget--Eisenhower's spending ceiling will largely be held.
-Taxes--Present excise and income rates will be extended. Ike won't get the gas tax hikes he wants. Passage is doubtful for bills on private pension funds and on foreign earned profits.
-Social security--Benefits will be expanded by as much as 10%.
-Education--The bill to construct classrooms won't get through.
-Labor--The minimum wage will be raised to $1.10 or $1.15 per hour; coverage, too, may be expanded to large retail outfits.
-Postal rates--Congress won't vote the increases Ike proposes.
-Housing--The outlook is gloomy for the Democrats' big measure.
-Health--Some health insurance bill for the aged may yet get by.
-Bond rates--The Democrats will block a hike in interest rates.

BUSINESS FAILURES WILL GO UP THIS YEAR, despite the general prosperity. Government economists attribute this gloomy prediction to two prime factors. Credit will remain scarce for most small businessmen, though money has eased a bit. Many new, small firms have been so hard pressed that they won't find it possible to hang on. Competition is also expected to be tougher this year than in recent years. Hardest hit will be firms in the food, clothing, and service lines. The number of bankruptcies will rise 10% in 1960, to 15,500.

HOW YOUR EMPLOYEES SHOULD HANDLE THEIR EXPENSES for travel, transport, entertainment, etc., is set out in a pamphlet now available from the Internal Revenue Service. The pamphlet tells what is--and what is not--deductible by employees. It also goes into the reporting and record-keeping requirements employees must meet. The pamphlet is free. Write to IRS, Washington 25, D.C.



New compounding guidebook shows how 25 Monsanto Plasticizers can help solve many adhesives problems

EXAMPLE:

Monsanto plasticizers help tailor PVAc emulsion properties to specific needs

Monsanto Plasticizer	Heat Sealability	Quick Tack	Flexibility	Performance	Relative Cost
AROCLOR 1211	Good	Excellent	Excellent	Good	Low
AROCLOR 1232	Good	Excellent	Good	Good	Low
AROCLOR 1242	Good	Good	Good	Good	Low
SANTICIZER 140	Good	Good	Good	Excellent	Medium
SANTICIZER 141	Good	Good	Excellent	Excellent	Medium
SANTICIZER 160	Good	Good	Good	Good	Medium
TRICRESYL PHOSPHATE	Good	Good	Good	Excellent	Medium
DIMETHYL PHTHALATE	Good	Excellent	Excellent	Good	Medium
DIETHYL PHTHALATE	Good	Excellent	Excellent	Good	Medium
DIBUTYL PHTHALATE	Good	Good	Excellent	Good	Medium
SANTICIZER B-16	Good	Good	Excellent	Good	High
SANTICIZER M-17	Good	Excellent	Good	Good	High
SANTICIZER I-H	Excellent		Good	Excellent	High
SANTICIZER 8	Good	Excellent	Good	Good	High
SANTICIZER 9	Excellent		Good	Good	High
DIPHENYL PHTHALATE	Excellent		Good	Good	High
TRIPHENYL PHOSPHATE	Excellent		Good	Excellent	High

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"*Monsanto Plasticizers in Synthetic-Resin Adhesives,*" new Technical Bulletin PL-307, contains up-to-date plasticizer performance data . . . *plus* detailed discussion of 51 specific adhesive formulas. Send for your copy, *today*.

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• **French Production of Polyethylene.** The Société Normande de Matières Plastiques, a division of the H.G.D. Air-Liquide et Ethylène-Plastique, reports that its new factory at Lillebonne near Havre will soon be on stream. This plant will produce low pressure polyethylene using the Ziegler process.

• A high density polyethylene made by the low pressure Ziegler process will be produced by Naphtachimie at its plant in Lavera, France. The plant was equipped by Pechiney.

• Commercial Plastics Ltd. and N.V. Boekelosche Stoombleekerij, Boekelo, a textile firm in Holland, have formed a joint company called Boekelo Plastics N.V. The new company will make Fablon and Boeklon Self-Adhesive Film, polyvinyl chloride textile laminates and other plastic materials and products.

• **First Plastic Pipeline in Great Britain.** The Esso Petroleum Co. has just signed a contract with the Imperial Chemical Industries for the delivery of ethylene which will be supplied using a pipeline from Fawley (Hampshire) to the factory of the Imperial Chemical Industries located at Gloucestershire —a distance of about 70 miles. The cost of the pipeline, the first of its kind in Great Britain, will amount approximately to $300,000.

• **USSR Molding Powder Installation.** The Techmashimport in Moscow has placed an order with two English companies, the Industrial Plastics Ltd. and East Anglia Plastics Ltd., for delivery of a factory installation which will produce cellulose acetate molding powder. The plant will have a capacity of 3000 tons a year. The cost of the installation will amount to approximately $300,000.

• **Polysulfide Sealer.** The European architects are following the pattern set up by their American colleagues and are using more curtain-walls. The exteriors of many new buildings erected in Europe very closely resemble American designs; generally speaking American methods have influenced European construction methods to a great extent. Europe was amazed to learn that we keep on building without interruption during the very cold winter months. The greater application of curtain-walls in Europe will considerably stimulate the consumption of polysulfide sealers. Liquid polymer and a few added ingredients constitute the polysulfide sealer which is a plastic, waterproof, nonrigid, non-hardening, polysulfide rubber with the ability to stretch to twice its length and recover to its original form.

The compound is packaged as a two-component mixture—an activator and a liquid polymer base compound. When combined, the activator acts with the base compound to form a synthetic rubber; when cured this synthetic rubber has the ability to withstand over 200 per cent elongation, has an ultimate range of minus 65° to 250°, and can be used to seal curtain-wall structures, bed thermopane, seal automotive windshields, caulk control and expansion joints, etc. It can be brushed on, painted on, poured on and used in many other applications.

In view of the fact that the European market is just starting, it might be advisable to investigate the possibilities of selling this material on a larger scale. The American manufacturer who turns out a good product and offers a good technical service will certainly reap a harvest before long.

• **East German Ethylene Plant.** The East German foreign trade corporation, DIA-Chemieausruestungen, has just signed a contract with two British companies —Humphreys and Glasgow, and Petrocarbon Developments—for delivery of the design and detailed engineering services of an ethylene plant having a capacity of 40,000 tons a year. The first stage of the new factory will be completed in December 1962. In all probability, East Germany will place more contracts with companies in Great Britain.

• **Inorganic Metal Adhesives.** Development of inorganic compounds which show promise as metal-to-metal adhesives stable to 750° F. is described in the *Financial Times*, London. The article was based on a U.S. report.

Five compounds were prepared in work toward development of inorganic metal-to-metal adhesives stable at 1000° F. All were stable from 750° F. to red heat, generally insoluble, and possessed very reactive atoms.

The promising products were melamine-phosphorus pentachloride, melamine-phosphorus oxychloride, melamine-phosphorus pentoxide, cyanuric trihydrazide-phosphorus pentachloride, and carbohydrazide phosphorus pentachloride.

• **Bacterial Growth in Latex.** Hevea latex is rich in mineral salts, sugars, amino-acid, complex proteins and natural growth factors and is consequently an ideal growth medium for micro-organsims. A highly interesting point is that factors used to increase productivity also help to produce a more easily infected latex.

The research institute in Vietnam has thoroughly investigated this phenomenon—and found that stimu-

A. Multiple layers of neoprene adhesive and neoprene sheet stock

B. Phenolic resin plastic

C. High tensile aluminum alloy

D. Special heavy aluminum oxide film (running surface)

E. Spring steel "L" edge

F. Fir plywood

NEW SKIS USE NEOPRENE ADHESIVE FOR COLD WEATHER FLEXIBILITY

The Head Ski Company's new VECTOR gives fast skiers remarkable stability and control on hard snow and ice... thanks to a resilient "sandwich" bonded by a neoprene adhesive.

Multiple layers of neoprene adhesive and neoprene sheet kill ski vibration. Their flexibility permits an engineered degree of twist, and produces a subtle tendency for the VECTOR to "snake," closely hugging the terrain.

Head's engineers worked closely with their adhesive supplier and selected a neoprene-based adhesive for this new ski design. Neoprene was recommended because of its unique combination of properties. Neoprene remains flexible at low temperatures, has exceptional mechanical strength, and resists natural aging.

Neoprene-based adhesives are available from adhesive manufacturers in both solvent and latex types. They can be compounded for application by brush, spray or roller and to meet a variety of service requirements. To solve current bonding problems... or perfect a new design... ask your supplier about adhesives based on Du Pont neoprene. Or, write E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department AA-6, Wilmington 98, Delaware.

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On the Continent (cont'd)

tion provides a higher phosphorus rate. Tests were therefore made to see whether a lower immunity of the latex could not be explained by the stronger phosphorus concentration. The relations between the glucide content in the latex and the effect of various tree treatments and latex infections have also been studied. Our French counterpart, *Revue Gènérale de Caoutchouc* devotes quite some space to this research project in its January issue.

• **Adhesives for Coated Papers and Cardboard.** Papers and cardboards coated with Saran or polyethylene are being used more and more in Switzerland. Quite a number of factories manufacturing packaging of all kinds are interested in a special adhesive for such coated materials. It seems that Swiss companies do not always like to weld these materials and prefer to manufacture bags, pouches and cartons in the usual way. For this reason a strong demand for a special adhesive has developed and one of the Swiss manufacturers has just put such an adhesive on the market. The Swiss product is called Miratex 70, an adhesive which, it is alleged, every packaging specialist should know.

• A new latex spreader was exhibited at the leather trade fair in Frankfurt a few weeks ago. The spreader, rather a large but very handy machine, accepts all kinds of latex and similar emulsions and spreads them very neatly on all materials such as leather, plastics, cardboard, etc., which are used in the small leather goods industry. The manufacturer claims that the machine is very economical, easy to use and can be applied to material up to a thickness of one inch. The spreader is very compact, well designed and has been well received by the industry.

• **East German Production Goals.** The iron curtain countries are making every effort in order to speed up their chemical industries. The latter have evidently been neglected for a number of years and are unable to meet present requirements. For this reason, a major part of the efforts of the various plants are at the present time devoted to the development of the chemical industry. East Germany has established the following goals in her latest Seven Year Plan, which runs up to 1965.

The accelerated development of the Chemical industry is the focal point of the plan. Most important is the development of the production of plastics, adhesives and synthetic staples. The production of plastics and adhesives has to be increased from 93,000 tons in 1958 to 153,000 tons in 1961. The goal is to wind up in 1965 with an output of 311,000 tons a year. The output of polyvinyl chloride has to be increased from 55,000 tons in 1958 to 126,000 tons in 1965.

The volume of polystyrene is scheduled to grow from 3700 tons to 20,000 tons. The 1965 goal for polyethylene is approximately 50,000 tons a year. Unsaturated polyester resins will be manufactured at the rate of 5000 tons a year in 1965. Only a few kinds of plastics will be manufactured in order to avoid the demand of numerous buyers for too many diversified and different plastic raw materials.

• **Adhesives More Important Than Fatty Acids.** The Deutsche Fettsaeure-Werke G.m.b.H., Witten (Ruhr), a subsidiary of the very well-known European Persil factory which produces a laundry powder, has discontinued manufacturing synthetic fatty acids and switched to the production of adhesives of all kinds. It is emphasized that at the present time there is a very huge market for adhesives both in Germany and within the confines of the European common market. The working capital of the company amounts to approximately 2.5 million dollars. All the shares are owned by Persil G.m.b.H. in Duesseldorf and the factory has been moved to Emlichheim/Emsland.

• **Adhesives vs Rivets.** The European press published quite a number of articles emphasizing the tremendous progress which has been made in the application of adhesives. It is pointed out that adhesives have replaced rivets, particularly in the production of airplanes, and a number of examples cited show that very often the bond between metal and metal is much stronger than the original material. The various kinds of adhesives suitable for this type of application are described. It is pointed out that the excellent qualities of the various products will certainly result in a much larger application.

A number of these articles are inspired by British companies. It might be a good idea if American factories would devote a little time to promote their products. Contact the commercial attachés of our various legations, the field offices of the Department of Commerce, in order to obtain proper guidance, addresses and other material necessary for an efficient campaign.

• **Dutch Carbon Black Plant.** The first carbon black plant in The Netherlands is now on stream in Rotterdam. Built in one year, the plant is operated by Ketjen-Carbon Ltd., a joint company of Godfrey L. Cabot, Inc. and Royal Sulfuric Acid Works Ketjen, Ltd. The stainless steel construction of the plant is designed to turn out five types of carbon black with extremely low grit content.

• A butadiene-styrene latex plant is being built in Great Britain by Witco Chemicals. Scheduled for completion some time next year, the plant is expected to have an 8,000,000 pound annual capacity of butadiene-styrene, high styrene, nitrile and other acrylic latices.

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2 Grades of Colton VINOL Polyvinyl Alcohol... PA-100 FH-1500

The polyvinyl alcohols in the beakers are equal in effectiveness, unequal in amounts. The ultra high viscosity Colton VINOL Polyvinyl Alcohol at the right is the equivalent of three times as much old-fashioned lower viscosity PVA shown at the left.

THEIR INCREASED THICKENING POWER MEANS LOWER PVA PERCENTAGES AND REDUCED COSTS

Colton VINOL PA-100, a very high viscosity (4% Solution = 90-110 cps) partially acetylated polyvinyl alcohol, and VINOL FH-1500, an ultra high viscosity (4% Solution = 140-155 cps) fully hydrolyzed polyvinyl alcohol, are used in *lower percentages* than other grades of PVA because of their increased thickening power in formulations. The result is lower finished costs.

VINOL PA-100 is recommended in adhesive formulations when re-moistening is desired and for best adhesion to smooth surfaces.

VINOL FH-1500 is unequalled when high water resistance is required. Its excellent wettability during solvation enables closer quality control and further reduces manufacturing costs.

Colton Vinols, compoundable with a wide variety of extenders, pigments, resins and chemicals, are used to control viscosity and the rate of penetration of adhesives . . . to increase their tensile strength and heat resistance . . . and provide solvent resistance. When used with such resins as polyvinyl acetate, Colton Vinols can control the rate of drying and speed of set.

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By NICHOLAS KOWALL and STANLEY HADYN

Pratt & Letchworth
Div. of the Dayton Malleable Iron Co., Inc.
Buffalo, New York

Corn Binders in Foundry Cores

Use of a combination of two corn-based binders improves both the green strength and the baked strength properties

By using core binders derived from corn, foundry cores of substantially improved properties and performance are being obtained by Pratt & Letchworth, Buffalo, N.Y. The binders are a corn cereal, used for green strength, and a corn sugar, added for baked strength. When used together in the sand mix, they complement and assist each other, and produce cores with better dimensional stability, improved surface finish and higher scratch hardness.

In addition, the cores bake so much faster than the oil sand cores formerly used that when the foundry installed new equipment that more than doubled its molding capacity, no additional core baking ovens were required.

Sand mixes containing the two corn binders have also speeded and smoothed the core room operation, eliminating the frequent cleaning of core boxes, the clogging of core blowing vents and periodic cleaning of arbors that were necessary when using oil sands. These advantages have been accompanied by important savings in the cost of sand sixes and in mulling, and by a one-third reduction in core scrap loss.

Pratt & Letchworth, Division of Dayton Malleable Iron Company, Inc., was founded in Buffalo in 1848. Capacity of the foundry is rated at 1000 tons of castings per month using electric furnace, or 1800 tons including open hearth production. A Grade B medium-carbon steel is used for most castings, but a small amount of low alloy castings is also produced.

Much of the output is in medium size castings for railroad equipment, generally from 50 lbs. to 250 lbs. Pratt & Letchworth's chief products are railroad accessory components. Recently the foundry has been diversifying its output and is now actively seeking high production work.

In its green sand facing mixes as well as cores, Pratt & Letchworth has used Mogul, a corn cereal produced by the corn wet milling process by Corn Products Company, for many years as its standard green strength binder. About two years ago, the foundry began experimenting with another product from the same supplier—Dexocor, a corn sugar base baked strength binder—as a replacement for core oils in the mix for its own pouring cups and funnels. Successful results with Dexocor for this purpose led to its adoption for core-room production mixes.

Improved Core Properties

When used together, the combination yields optimum core properties. In addition, each binder helps the other perform its function. The Mogul, used primarily for green strength, also retards migration of the Dexocor, resulting in uniform hardness of core interiors. The Dexocor, in turn, also aids green properties and permits a reduction of 10 to 25 per cent in the amount of Mogul needed, compared to the amount required in oil sand mixes. Further savings result because less fuel is required at the baking ovens, and because, gallon for gallon, material cost of the Dexocor is about 25 per cent below that of core oils.

Pratt & Letchworth employs only one base sand for all jobs, namely a 4 screen portage silica sand with an AFS fineness of 51. From the storage silo in the yard, the sand goes by dump truck to a bucket elevator that raises it to overhead bins. From these bins it flows by gravity to a weigh-larry and then to the mullers.

The foundry uses a mixture of 50 per cent new sand and 50 per cent scrubbed sand, reclaimed in a pneumatically operated unit that can handle up to three tons per hour. Adoption of the corn sugar binder simplified the formulation of mixes. Now, all mix ingredients, except of course water and release agent, are added to the sand in the dry state.

The batch formulation for the mix used to make pouring cups is as follows:

Portage sand, AFS No. 51	1200 lbs.
Dry reclaimed sand	1200 lbs.
Mogul corn cereal binder	4 gals.
Dexocor corn sugar binder	100 lbs.
Fire clay	4 gals.
Silica flour	400 lbs.
Water	16 gals.
Release agent (1 gal. Kerosene, 1 pt. oleic acid)	1⅛ gals.

Automatic moisture control equipment is employed to govern the addition of water. Using this equipment, moisture in the sand mix is controlled to within plus or minus 0.1 per cent.

The production mix for cores used to make low hot strength sand is put together as follows:

Portage sand, AFS No. 51	1200 lbs.
Dry reclaimed sand	1200 lbs.

Operator adds corn sugar baked strength binder to sand mix in one of the company's two 3000-lb capacity mullers. A corn cereal binder is used for green strength and the combination of the two corn derivatives improves core properties.

Mogul corn cereal binder	8 gals.
Dexocor corn sugar binder	6 gals.
Fire clay	2 gals.
Wood flour	10 gals.
Water	8-8½ gals.
Release agent (5 qts. kerosene, 1 qt. oleic acid)	1½ gals.

Pratt & Letchworth uses two No. 3 Simpson mix mullers, with a capacity of 3000 lbs. each for its core and facing mixes. The usual mulling cycle for core sand mix by the company is as follows:

1 min.	Dry
6 min.	Wet
10-15 secs.	Release agent added

The mulling cycle was shortened by two to three minutes by using Dexocor since this material, being water soluble, disperses more rapidly.

Tests run on core sand mix at this foundry include a screen analysis to determine grain size, a moisture content determination, green compression strength, permeability, green flowability, hot strength, and deformation. Test results on the core sand mix for railroad castings are as follows:

Moisture	3.7-4.2 per cent
Green compression	2.2-3.2 psi
Green permeability	100-140
Green flowability	80-90 per cent

Removing core box from blown core. The use of corn-derived binders makes it possible to wash down core boxes with water alone.

Molder checking tolerance of cores after insertion in mold. Pratt & Letchworth is maintaining tolerances within plus or minus 1/64 of an inch.

Representative group of cores made with combination of corn binders. Company makes castings for railroad equipment.

Sand mix from the mullers goes on a belt conveyor to 14 benches and four blowing stations in the core room, traveling 100 to 500 ft. As the sand mix reaches a core blowing station, an electronically operated plow, actuated by pushing a button, drops down and plows the sand mix from the moving belt into a hopper at each bench or station as needed. An operator at a master control board can tell by lights on the board when sand is needed at the benches or blowers and can direct the flow of sand as required.

Pratt & Letchworth uses blowing, hand ramming and jolting for core making. About two thirds of the cores are blown; the remainder are rammed or made on jolt machines.

The core blowers are capable of producing up to 300 20-lb. to 40-lb. cores per hour and 150 40-lb. to 100-lb. cores per hour.

Offers More Resistance

Core sand mix containing Dexocor was found to offer slightly more blowing resistance than oil sand mixes. To compensate, the size of the blow holes in the blow plate or head was increased from 1½ to 1¾ inches in diameter. This was the only change required when converting from core oils to the corn sugar binder.

Cores made with Dexocor have more resistance to sag, and overhangs.

Routine maintenance of core room equipment has been made easier since the changeover to the corn sugar binder. Formerly, when core boxes were put on the core blower, the oil residue hardened up in the vents, requiring cleaning or replacement.

Cleaning Boxes

Core oil residue also hardened in the core boxes. It was necessary to clean the boxes thoroughly before storing, or it would be difficult to draw cores when the boxes were used again.

Now, using Dexocor instead of core oil in the mix, washing with water alone quickly and easily cleans core boxes and equipment. When using oil, vent plugs became blackened and had to be cleaned every sixth blow. Now, no cleaning whatsoever is needed.

Most cores are sprayed with core wash, using a refractory material with a silica base.

Core baking is done in 12 oil-fired batch or rack baking ovens. The ovens have three compartments and accommodate two racks in each compartment. Their temperature range is from 430° to 460° F.

Reduced Baking Time

Use of the new binder has reduced core baking time by 25 to 40 per cent compared with cores made from oil sands. The baking cycle for cores for draft gear castings ranged between 2½ and 2¾ hours when these cores were made with core oil. The same cores made with the corn sugar binder bake in from 1¼ to 1½ hours.

In addition to saving fuel, this substantial reduction in baking time suddenly became extremely important when the foundry recently installed a four-station hydra-slinger with highly increased capacity using 40 x 60 in. flasks. This new equipment substantially increased molding capacity, yet the increased rate of molding was handled without need for installing additional core baking ovens, due to the faster drying rate of the cores made with Dexocor.

Baked properties of cores made with the corn binders are outstanding. Greater dimensional accuracy is an important feature of cores for railroad components. No machining is done on these castings. Pratt & Letch-

About the Authors . . .

NICHOLAS KOWALL joined P&L in 1957 as superintendent. A graduate of the University of Alabama, he is director of the Western New York Chapter, American Foundrymen's Society.

STANLEY F. HADYN supervises the P&L Core Room. He joined the company in 1936 as a technician in the Sand Control Laboratory and participated in its Molders Apprenticeship Program.

worth works to tolerances of 1/32 of an inch in 12 inches on these parts and is actually achieving tolerances within plus or minus 1/64 of an inch. With a scratch hardness of 90-100, the cores are easily handled without damage to the surface.

The new cores likewise produce castings with appreciably better internal surface finish. The hot strength developed in the cores has greatly reduced erosion of the sand and metal penetration and there has been much less tendency for scabbing.

Another unusual feature is the ability to put a rack of underbaked cores back into the oven. With core oil sand mix, once the cores were out of the oven they could not be put back without sacrificing baked strength. Most of the core scrap loss resulted from the impossibility of redrying oil cores. The new cores made with corn binders can be returned to the ovens and redried to get full strength. Also, using the new cores, there is less chance of a defective casting resulting if cores are not absolutely dry.

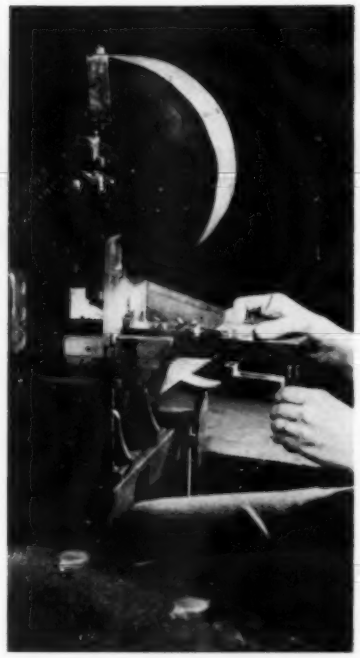
Conveyor Travel

From the ovens, the cores travel by another conveyor to the molding stations. Ordinarily, cores are used soon after they are baked. In dry weather, however, the new cores may be kept ten days to two weeks and used without difficulty. In one case, two cores made with the new binder materials were used after standing six months and still produced castings without surface defects.

Dexocor has also been incorporated in P & L's green sand core mix. The addition of Dexocor permits a rapid crust formation in a drying time of 10-15 minutes. These cores are dried just long enough to obtain a hard crust to facilitate their handling.

Fully baked cores made with sand mixes containing the corn binders have good collapsibility and do not cause trouble at shakeout stations.

In summary, use of these complementary corn binders has provided a balance of desirable core properties not previously attained with any other combination of binders. The cores show excellent green properties, high baked strength and scratch hardness and resistance to metal penetration. They have better dimensional stability for close tolerance work. Important savings have resulted from lower material cost, faster baking time and reduced maintenance of core making equipment.



Adhesive-dipped metal insert is manually inserted (above) into lug hole in the ring and percussion plate. Electrically powered device (right) exerts pressure on bonded parts to finish the operation.

Toy pistol gets a

Whizz Bang Bond!!

The high strength and vibration resistance of a unique quick-setting adhesive have added life to a critical part of a toy pistol. Though the adhesive is one of the most expensive on the market, production engineers have found its use quite economical since they obtain approximately 4000 bonds per ounce.

The toy, called the Ric-O-Shay Pistol, produced by The Hubley Mfg. Co., Lancaster, Penna., has a device mounted in the butt which simulates the sound of a whining bullet when the trigger is released. Generated by a wire vibrating against a thin brass percussion plate, the effect, pitch and duration of the sound are dependent upon the positioning and rigidity of the wire's fixed end.

To gain the necessary rigidity, a zinc alloy slug is die-cut onto the fixed end of the wire. This slug fits into the die-cast ring which surrounds the percussion plate. Sufficient clearance is provided to allow for "tuning" by tapping the slug.

Of course, any movement of the slug after tuning would change the effect of the sound. Since the vibration of the wire would soon loosen the press fit, the two parts must be permanently secured after tuning.

Mechanical Method Tried

Several mechanical methods were investigated, as were a number of adhesives. Because it bonds without catalysts, heat or solvent evaporation the most successful was found to be Eastman 910 Adhesive manufactured by Eastman Chemical Products, Inc.

In production, the slug is dipped into a trough containing the adhesive. It is then mechanically pressed into a hole in the ring and the entire unit passes to the final position on the assembly line where it is tuned.

Because of its rapid-setting, high-strength and resistance-to-vibration characteristics, the adhesive allows no further movement after the tuning step.

Mortar Modified with Polysulfide-Epoxy Adhesive Speeds Roadway Repairs

Development of a new technique for filling ruts and dips permits job to be sandwiched in between hours of heavy commuter traffic on Richmond-San Rafael Bridge

The use of a polysulfide modified adhesive mortar to fill a rut or dip in concrete roadways was demonstrated recently in a remedial project on the Richmond-San Rafael Bridge in California.

A bridge roadway dip caused by failure of mortar surfacing was a potential threat to highway safety. Up to ¾ of an inch deep and ten feet wide, the dip stretched 36 feet across several lanes. Because the dip threatened to enlarge, the California Division of Highways decided to begin repairs as soon as possible.

Conventional repair techniques would have required removal of base concrete until some of the reinforcement steel was bared. Then the new concrete would have been laid and smoothed to the desired level.

Time and Labor

Of course, the big drawback to such a technique was the amount of time required to make the repair—time in which the flow of traffic would be impeded. In addition, a considerable amount of labor would have been required to remove the base concrete.

The engineers considered accomplishing the repair with polysulfide modified epoxy adhesive and a new concrete overlay. This would have required merely sandblasting the area to be covered, applying the adhesive and laying the thin concrete overlay. From past experience the engineers felt certain that such a technique would cut the cost and time, and at the same time provide a permanent overlay for the road.

However, this too had a drawback. The time required for the concrete to set and become sufficiently strong would still tie up traffic longer than was desirable.

The fact that only a ¾ inch overlay was required to fill the dip was what finally led the engineers to their decision to employ a polysulfide modified epoxy mortar—a mixture of the adhesive and aggregate. By so doing, the time the lanes had to be closed to traffic would be held down to only a few hours. In other words, the repair could be sandwiched in between the hours of heavy commuter traffic. This also meant that concrete mixing machines need not be called out for the job.

Sandblasting was required to clean off loose particles and oil film in order to give the mortar a good surface to which it could bond. The adhesive composition developed by the Division of Highways consisted of liquid epoxy resin, liquid polysulfide polymer and curing agent.

After these ingredients were properly mixed, enough white filler was combined to give the finished mortar a concrete-like appearance to match the rest of the roadway. The adhesive was then poured into a mortar box, combined with aggregate in a one to fifteen ratio, and the mortar was ready for application.

Actual application of the mortar was similar to techniques used with concrete. As the void was filled with shovels of mortar, a screed was worked over the material to smooth the surface. Since little solvent is used in the compound, shrinkage was not a problem. Sand was sprinkled over the application, and a wood float was used to smooth the material.

Since the pot life of this chemically cured mortar is less than an hour, mixing was done in batches and applied in sections about two feet by ten feet. Pot life could have been extended, but it was not deemed necessary in this application.

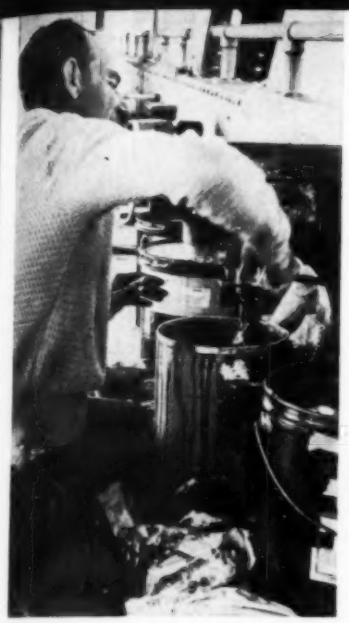
Experimentation has shown that the curing time for such a mortar varies with the temperature—shorter periods are required as the temperature is increased to 250° F. At 80° F the mortar would be sufficiently hard to take traffic in about twelve hours. By applying heat, the curing time could be reduced to one hour.

Use Propane Burners

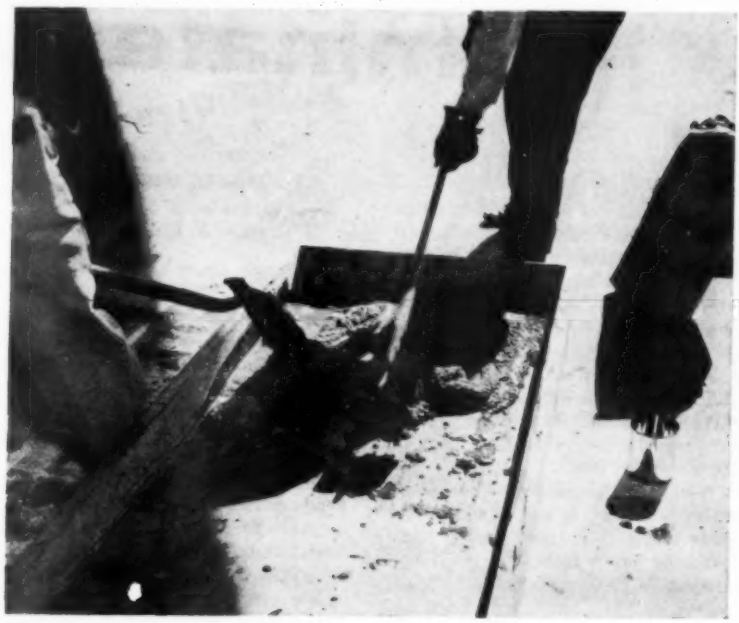
The highway engineers compromised by heating the applied mortar for about one half hour and leaving the lanes closed overnight. Propane burners were used to apply the heat. Actually the road could then have been opened within four hours without damage to the resurfaced area.

Since 1953, the California Division of Highways has experimented widely with the polysulfide modified adhesives as they can be utilized for highway remedial work. Many of the applications have been in service for five and six years, and the results have been highly satisfactory.

Step-by-Step Repair of Bridge Roadway Dip



▲ Ingredients of the adhesive compound are shown being mixed. The adhesive and aggregate are combined in a ratio of 1 to 15.



► Sand is blended into the adhesive compound to make the mortar. Only enough for a single road section is prepared at one time.

▼ As one worker puts mortar on the road, the other works the screed to level the material into place. Area is then sand sprinkled.

▼ In photo below, worker gives final touches to one section of the repair work. Compound is chemically cured and assures a tight bond of the overlay to the base concrete.

Sonic Detection of Flaws in Laminates

By JOHN O. McCUTCHEON
Argus Engineering & Development, Ltd.
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Small areas of bond failure one or more layers below the surface of a multilayer sheet material can now be detected by high frequency audio waves. The bond failures may be blisters caused by trapped steam or may originate from variations in veneer thickness or in glue spread, etc. Faults can be detected even when there is no measurable separation between the layers at the point of the defective bond.

A device employing this sonic technique, the Argus Sonic Bond Discriminator, is now being commercially produced by Argus Engineering & Development Ltd., Vancouver, B. C., Canada. In operation, the unit's detector head, which contains an acoustically shielded brushing mechanism and microphone, is traversed across the material under inspection. The brushing causes generation of a sound whose characteristics are related to the local acoustic impedance of the material. This impedance changes when the detector head passes over a hidden bond defect. The resulting change in sound characteristic is greatly amplified, filtered to remove most ambient noise, compared to the norm, and through an electronic relay closes a defect signalling circuit in the mechanism.

Further investigation of the mechanics of detection indicates that sonic detection is made possible by: (1) a decrease in the level of high (audio) frequency response which occurs as material thickness increases, and (2) a reflection effect which increases the high frequency response from no-bond areas. The first effect appears to be more important with thin materials, and the second, with thick materials.

Research and development work on the detector has been described by the inventor, Donald G. Miller of the Canadian Forest Products Laboratories, in a paper presented in February, 1959, before the Forest Products Research Society and published in the September 1959 journal of the society. The work was originally undertaken to solve a specific problem in the plywood industry, but from preliminary tests the detector appears to have application to many laminated materials where individual layers are relatively thin: honeycomb construction, particle boards, and various combinations of metals, plastics, and wood.

Development of commercial units was undertaken in March, 1959. The first model produced is a single head portable with a detector head which may be traversed manually over the surface being inspected. Energy received by the microphone is returned to a high gain amplifier, where voltage amplification is about 100,000 times (100 db gain), and passed through a band-pass filter which effectively screens out the lower and middle audio range frequencies which contain most ambient noise.

Feed Electronic Relay

The output from the filter is fed to an electronic relay which may be set to trip when a defect of a certain minimum size is encountered. The model has a 5-inch diameter brush designed to pick up defects of approximately equal size at the center glue-lines, the minimum size depending in lesser degree on ambient noise level.

The sensitivity of the instrument appears to decrease sharply as the ratio of depth of the no-bond area to panel thickness increases, and reliable detection is not possible at ratios of 0.5 and greater. In other words, the detector "looks" only to the mid-thickness of the laminated material. To inspect all glue-lines, both faces of the material must be traversed with the shielded brushing mechanism

The all-aluminum housing containing the detector head has an acoustically shielded lower half and an upper cover. A fractional horsepower motor in the upper section drives an annular brush by means

About the Author . . .

JOHN O. McCUTCHEON is president of Argus Engineering & Development Ltd. He holds B.Eng. and M. Eng. degrees from McGill University. Mr. McCutcheon is the author of numerous articles dealing with wood technology.

Generation of a sound with characteristics related to the local acoustic impedance of the material being tested permits detection of hidden bond defects by measurement of changes in amplified audio response

of a countershaft. All bearings are anti-frictional, and the brush is driven through loose-fitting pins so that it has a verticle "floating" motion as it crosses the surface under inspection. A microphone is suspended in resilient material in the center of the brush.

A 15-foot length of cable connects the detector head to the electronic cabinet. The cable contains the microphone lead, a drive circuit for the motor, and a relay circuit leading to a defect indicator light mounted in the upper housing. The contact surface between the detector head and the material being inspected is a machined ring of low-friction teflon.

The aluminum cabinet has been designed for minimum weight. It contains a high gain audio amplifier, a band pass filter, an electronic relay, a constant-voltage power supply, an audio VU meter, and trip and sensitivity controls. The rear cover can be removed to provide access to tubes and rear panel controls. The front panel contains the connections for the detector lead cables, the VU meter, the "sensitivity" and "trip" settings, and a defect signal light. Power is supplied by 110-volt AC mains.

The "sensitivity" setting controls the over-all gain and is indicated by the VU meter reading. "Trip-set" controls the point at which the defect indicator will operate (*i.e.*, the minimum size of defect which will actuate the relay). Energy generated when the detector head is on a thin panel tends to be greater than when it is operating on a thick panel. In many thin panels the detector need only inspect the first glue-line. Hence "sensitivity" will normally be set at a lower level when inspecting thin panels.

Maximum bond defect size acceptable to the operator is taken into account by the relative settings of "sensitivity" and "trip-set." Also, the strength of the acoustic signal generated is related inversely to the smoothness of the surface. Varying surface treatments will require corresponding variations in "sensitivity" positions.

The detector head has heavy duty anti-friction bearings for long life. The brush has approximately ¼ inch of free verticle travel and is self-compensating for bristle wear. While the amplifier and associated electronic equipment have some unusual features, all component parts are readily available and service life should be long, under normal conditions, if excessive impact and dirt accumulation are avoided.

Further discrimination can be obtained with a brushing element with a small diameter, and a similar portable model with a 2-inch diameter brush is planned. A production line unit which will allow simultaneous inspection of both sides of a continuous stream of panels travelling at rates up to 150 ft. per min. has been under study for some time and a tentative specification has been established. To obtain adequate sensitivity, this unit must be made up of a series of brush-microphone assemblies, each acoustically isolated, with each signal amplified and screened separately. Initial design work on such a model has been done.

An Argus Sonic Bond Discriminator is adjusted in the laboratory. Only two operator controls are utilized in preparing the device to locate defects. The setting of the "sensitivity" and "trip-set" controls depends on the depth of the material to be inspected.

By C. A. BERRIDGE and D. P. SPALDING

Silicone Products Department
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How to Bond Silicone Rubber

A practical breakdown into five distinct categories of bonding problems encountered when working with silicones

A significant portion of the now multi-million dollar fabricated silicone rubber business has developed because silicone rubber can be successfully bonded to itself and other material surfaces.

The successful bonding techniques have been developed in the face of the fact that silicones are noted for their non-sticking properties. In fact, numerous applications for many silicone polymers (fluids, resins, etc.) are based on the excellent release properties of silicones.

As anyone familiar with the field will readily agree, continued improvement of bonding techniques with silicone rubber will be welcomed by those faced with the fabrication of finished parts. It is our purpose to review the existing bonding technology and to present some of the latest advances in the technology with new techniques that have eliminated or minimized some of the more difficult bonding problems with silicone rubber.

Most of the bonding problems with silicones can be classified in one of five categories:

(1) Cured silicone rubber to cured silicone rubber.
(2) Cured silicone rubber to metal.
(3) Cured silicone rubber to plastic.
(4) Uncured silicone rubber to cured silicone rubber.
(5) Uncured silicone rubber to metal.

Bonding a silicone surface to a silicone surface is not usually a difficult problem. The difficulties involved in the bonding of silicone rubber result from the need to adhere to a non-silicone surface. In all cases, the difficulty is met by first converting the non-silicone surface through the use of primers.

The primers employed are solutions of silicone monomers or prepolymers. Because of the low molecular weight of these materials, intimate contact is made with the non-silicone surface. After application the primer polymerizes to a higher molecular weight by hydrolysis with atmospheric moisture or by condensation polymerization under heat application.

By this device, a silicone polymer surface is placed in intimate contact with the non-silicone surface. The subsequent bonding problem then becomes the relatively simple one of bonding a silicone to a silicone.

Case I—Cured Silicone to Cured Silicone—Cured silicone rubber is bonded to cured silicone rubber by the use of uncured silicone rubber as an adhesive. Virgin stock of the same composition as one or both surfaces is used. Both surfaces are thoroughly cleaned, usually with a degreasing solvent such as toluene, xylene, or perchloroethylene, and a layer of thoroughly freshened (or plasticized) uncured silicone rubber stock is placed between them.

Next, the joint is placed under sufficient pressure to insure good contact and heat is applied. Sufficient time must be allowed to permit all of the rubber in the joint to reach 250° F. for about five minutes. The assembled part may then be oven cured for any specified cycle.

Quite often, however, the use of virgin stock of the same composition as the cured rubber being bonded will fail to produce good bonds because of that particular stock's poor flow or wetting characteristics. In these cases, it is better to use a separate silicone rubber paste compound as an adhesive for the cured silicones. This subject will be more thoroughly covered below in Case VI which covers the bonding of high strength silicones.

Case II—Cured Silicone to Metal—Silicone rubber can be easily bonded to aluminum, copper and steel by following these basic steps of procedure:

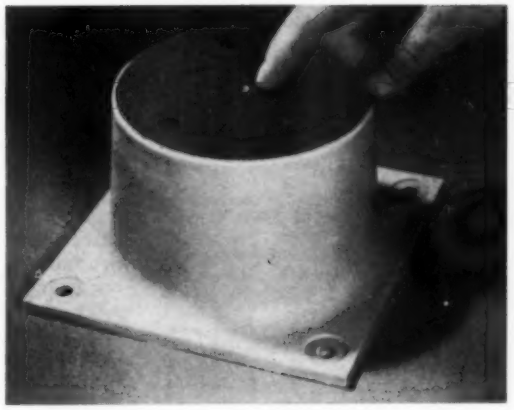
Table I—Bond Strength for RTV-90 Lbs/Inch Width

Cured Rubber	*Adhesive Compound*					
	SE-100 Milled	*SE-100 In Solvent*	*SE-1010 Milled*	*SE-1010 In Solvent*	*C-319 RTV*	*RTV-90*
SE-555		3	35+[1]	24[1]	22	8.0
SE-565			35+[1]	28[1]	22	8.0
SE-472			10+[1]	16[1]	19	8.0
SE-555				49[2]		
SE-565				42[2]		

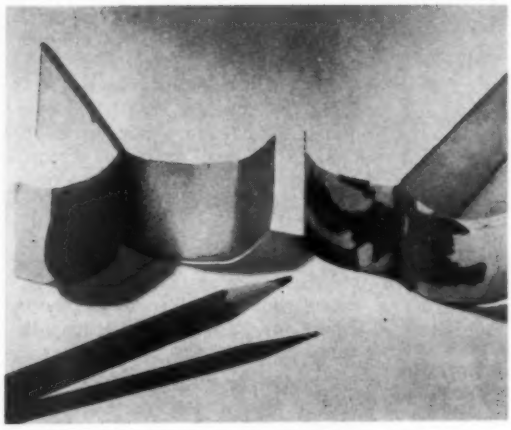
[1] The cured rubber strip failed in tear strength before bond. [2] Double layers of cured rubber bonded to each other. This value is the true value of the bond strength.

Bonding Silicone Rubber to Metal

Examples of cured silicone rubber bonded to itself. Unsuccessful specimen on top was caused by use of uncured compound of same stock as materials being bonded.



Typical example of a successful production fabrication is this shock mount using silicone rubber bonded to steel.



Improper priming, far left, caused stressed silicone rubber to pull away from metal. In proper bonding, rubber tore.

(a) Clean cured silicone rubber with a solvent scrub and rinse.

(b) Clean the metal in a similar fashion.

(c) Treat the metal surface with a silicone primer, allow to dry thoroughly.

(d) Apply adhesive (best to use a paste type silicone compound such as SE-100 or SE-701).

(e) Apply heat and pressure (10 to 30 minutes at 300° F.).

Some commonly used primers for bonding silicone rubber are: SS-67[1], 81822[1], Chemlock 602[2], Chemlock 607[2], and DC 4094[3].

The above general procedure is successful in most instances. Many times, however, the bonding of silicone rubber to metal is a complex molding operation where the uncured silicone rubber must flow over a metal surface that is primed for bonding. The flowing action may wipe the primer from the metal and produce at best a weak or spotty bond. This difficulty can be eliminated by one or more of several ways:

(1) Where possible, factor this problem into the mold design, eliminating or minimizing compound flow over the primed surface.

(2) For existing molds, preform the uncured compound over the primed areas to minimize compound flow in those areas.

(3) Treat the primed metal by curing the primer onto the metal using an oven cycle of 10-20 minutes at 200° F. to 300° F. This heat treatment can also be affected by heating the metal insert in the transfer mold for a few minutes prior to injection of the rubber.

(4) Clean and prime the metal. Coat the problem area with a thin layer of silicone rubber paste from a solvent dispersion and cure this thin layer in an oven. Then proceed with the molding-bonding operation as a Case I or Case V problem.

Another variable to consider is the required state of final cure of the total construction. If the end use indicates a long and/or high post-vulcanization cure for the total construction, some further refinements in technique should be observed. Thus Chemlock 602 is superior to Chemlock 607 as a primer in such circumstances.

The peroxide used as the curing agent for the rubber is also critical. For high temperature cured bonds DiCup 40C is the superior rubber curing agent. Bis (benzoyl) peroxide is satisfactory but more sensitive to handling variables. The catalyst, bis 2, 4-dichlorobenzoyl peroxide catalyst should be avoided in any bonding application.

Case III—Cured Silicone to Plastic—The same procedure is used in this case as in the case of silicone rubber to metal. Since there are some temperature limits in the use of plastics,

Notes: [1] General Electric Company, Silicone Products Department, Waterford, N.Y., [2] Lord Manufacturing Company, Erie, Penna., [3] Dow Corning Corporation, Midland, Mich., [4] Connecticut Hard Rubber Company, New Haven, Conn.

About the Authors . . .

CHARLES A. BERRIDGE joined G-E's "Chemet" program for chemists and graduate engineers after receiving his B.S. in chemistry from the University of Wisconsin in 1953. He is now a specialist on rubber market development in the Silicone Products Marketing Section.

DAVID P. SPALDING is a technical service specialist in G-E's Silicone Products Dept. He received his M.S. and Ph.D. degrees from Penn State University. Dr. Spalding holds several patents for his work in the field of silicones.

the use of RTV adhesives described below is particularly recommended in this type of bonding application.

Case IV—Uncured Silicone Rubber to Cured Silicone Rubber—This is actually a specialized version of the first general case. The bond is produced simultaneously with the curing of the uncured silicone rubber. The cured silicone rubber must be properly cleaned. The uncured silicone rubber acts as its own adhesive. Pressure must be applied to maintain sufficient contact of the two materials. Heat is applied to cure the uncured rubber. Simultaneous with this cure the bond is established.

Case V—Uncured Silicone to Metal—This is a specialized version of Case II. All of the procedural steps of Case II should be followed, except the application of adhesive. As in Case IV, the uncured rubber serves as its own adhesive.

Special Cases and New Technology

Case VI—Bonding Very High Strength Silicone Rubber—Today's high strength silicone rubber compounds such as SE-555 and SE-565 would give the best results in bonded seals, etc. if a bond could be formed which was equally as strong as the cured rubber. We stated earlier that the use of virgin high strength molding compound as an adhesive often fails to produce a good bond.

It is obvious that the use of the common adhesive paste compounds, such as SE-100, could lower the over-all utility of the high strength rubber part because of the weak bonds produced by such low strength compounds. Described below are some new techniques which have been found to successfully produce extreme high strength bonds with today's high strength silicone rubbers.

Table I shows the results of bonding SE-555 and SE-565 to themselves with two new adhesive compounds compared to the old SE-100 adhesive compound.

The new adhesives were C-319 RTV[4] and the new SE-1010U[1] compound for coating applications. The C-319 RTV was applied as directed by the manufacturers' instructions. The SE-1010U was applied in two ways:

(1) Add one per cent benzoyl peroxide powder on a rubber mill. Remove from the mill in 30 mil sheets. Apply the 30 mil strip between the cured rubber strips as an adhesive.

(2) Disperse SE-1010U in butyl acetate solvent at 60 per cent solids. Add one per cent benzoyl peroxide powder by weight of SE-1010U. Apply with a spatula as a cement, allow to dry in the air for two hours, join the cured strips to be bonded and cure with heat and pressure.

The 1″ x 5″ cured rubber strips were cut from ASTM test sheets of SE-555[1] and SE-565[2] and bonded as described above. Cure cycle in the press was 10 minutes at 300° F.

Case VII—Bonding Cured Silicone Rubber with the RTV Silicones—There are many areas where cured fabricated silicone rubber could be used but have previously been barred from use because of the difficulty or impossibility of bonding the cured rubber in place.

The new RTV (room temperature vulcanizing) silicone rubbers can be used to bond cured silicones in all types of difficult bonding situations. The RTV silicones such as RTV-90[1] or RTV-60[1] will bond silicone rubber to silicone rubber, to metals and to cured plastic compositions.

The procedure for bonding to silicone rubber is:

(1) Baked the cured rubber in an oven at 300 F. if not previously post cured.

(2) Clean with solvent scour and dry.

(3) Add the catalyst to the RTV silicone, apply and maintain contact pressure until cure is complete.

To bond RTV silicone rubber to metals and cured plastics use the following procedure:

(1) Clean metal with solvent scour.

(2) Apply RTV silicone primer solution XS-4004[1] to give a bright pink color on drying. (Proper color to be determined empirically.) Dry one hour.

(3) Add catalyst to the RTV silicone, apply and maintain contact pressure until cure is thoroughly completed.

When bonding to porous wood, ceramics, or other difficult to bond surfaces, good bonds have been obtained by using a double primer system. First apply the primer 81822 and dry. Use one or more applications as needed. Then apply the XS-4004 primer and proceed as above. The typical bond strength obtained for RTV-90 is shown in Table I.

Tables II to IV present data on the performance of the RTV silicones bonded to aluminum under a variety of severe test conditions. These data were presented to the S.A.M.P.E. Symposium on Sealants at Los Angeles in October 1959.

Table II—RTV Bond Strength After High Temperature Aging*

Aging Time & Temperature	*Bond Strength at 77° F. Lbs/Inch Width*
48 hrs/77° F.	9.8
48 hrs/77° F. + 1 hr/300° F	9.3
48 hrs/77° F. + 24 hr/300° F.	10.6
48 hrs/77° F. + 200 hr/300° F.	7.9
48 hrs/77° F. + 1 hr/480° F.	5.4
48 hrs/77° F. + 24 hr/480° F.	3.9
48 hrs/77° F. + 200 hr/480° F.	3.2
48 hrs/77° F. + 1 hr/600° F.	3.9
48 hrs/77° F. + 24 hr/600° F.	4.9
48 hrs/77° F. + 200 hr/600° F.	2.5

* RTV-90 bonded to No. 1100H-14 aluminum primed with XS-4004

Table III—Bond Strength At High Temperatures*

Test Temperature	Bond Strength, Lbs/In. Width 0.1% Thermolite-12	0.5% Silicure L-24
300° F.	7.6	7.8
400° F.	7.3	8.0
600° F.	5.0	5.3

* RTV-90 on aluminum primed with XS-4004 cured 48 hours at 77°F. Samples held ten minutes at test temperature.

Table IV—Bond Strength After Fluid Immersion RTV-90 on Aluminum Primed with XS-4004 Cured 48 Hr/77°F., 0.1% Thermolite-12

Primer Drying Cycle Before Bonding	ASTM #3 70 Hr/ 300° F.	MIL-L 7808* 70 Hr/ 300° F.	Skydrol 500 70 Hr/ 212° F.	168 Hr/ 77° F.	JP-4 70 Hr/ 80° F.
	Lbs/Inch Width				
1 Hr/77° F.	8.4	9.8	3.4	0	0
10 Min/77° F. + 5 Min/300° F.	9.4	10.8	3.4	No Test	0
10 Min/77° F. +10 Min/300° F.	7.3	11.3	9.4	No Test	3.9
10 Min/77° F. +20 Min/300° F.	9.4	11.3	4.9	0	3.9
10 Min/77° F. +60 Min/300° F.	7.3	10.6	9.3	No Test	3.4
10 Min/77° F. +10 Min/480° F.	7.3	8.4	9.4	No Test	3.4

* Anderol 774

Table II presents data on high temperature aging. An important factor often overlooked in aging data is the strength of a sealing compound when it is pulled or stressed at some very high temperature. Most elastomers lose at least one-half their room temperature strength when they are heated as can be seen by the table.

Table III shows that the RTV silicone rubber compounds retain their strength at these temperatures. The samples were tested in a controlled temperature heating chamber. They were held at temperature for ten minutes to allow them to attain temperature equilibrium before pulling for bond strength.

Table IV shows the ability of RTV silicone rubber bonds to withstand immersion in fuels and other fluids at high temperatures. The samples were prepared as described previously and cured 48 hours at 77° F. They were immersed in the fluids, aged, removed, cooled and tested following ASTM oil testing procedures as closely as possible. The data in Table III also illustrate the effect of different primer drying time-temperature cycles on the bond behavior in the fluids.

A Coating of Plastic

Technique originally developed for the U.S. Navy is used to give New York's newest museum a protective coating that can be cleaned by hosing it down

New York City's Solomon R. Guggenheim Memorial Museum is protected against wind, water and weather by a special vinyl coating that is expected to give at least ten years of service before any recoating is required. The abrasive-resistant surface can be given its spring cleaning by simply hosing it down with plain or detergent-containing water.

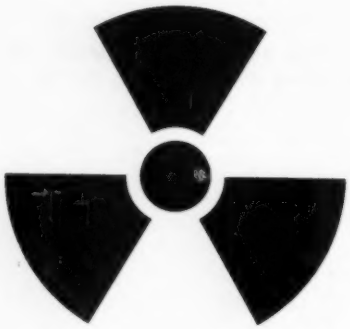
In addition to protecting the museum against the elements and air pollutants, the ivory-tinted vinyl surface highlights the monolithic texture of the concrete exterior.

The liquid vinyl formulation is applied to the concrete by spraying. The so-called "Cocoon" coating technique used was developed by R. M. Hollingshead Corp., Camden, N. J. Actually a series of coats, it includes a strongly adhesive primer and an outercoat which has great cohesive strength.

The coating is jointless, fills the hairline crack characteristic of poured concrete surfaces and expands and contracts with the structure itself. Its expected longevity is based on the fact that it does not oxidize or erode.

Cocoon coating was developed by Hollingshead under a research and development contract with the U. S. Navy. It is based on Baklite vinyl resin manufactured by Union Carbide Plastics Co. For several years, the entire Cocoon output was earmarked for mothballing ships, gun positions, and other military equipment.

Museum entrance, which was also vinyl coated, seen from the topmost ramp.



By R. F. WEGMAN and M. J. BODNAR
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Bonding Uranium 238

New technique eliminates oxidation problem by combining abrasion and adhesive coating steps into one operation

To help meet the complex requirements of modern technology, adhesives are called upon to bond many unusual materials. One such material is uranium 238.

Pure uranium is a white metal which is quite active chemically and unites with oxygen, nitrogen, carbon, and sulfur at ordinary temperatures and with the halogens at elevated temperatures. Through oxidation, it tarnishes very rapidly in air. This rapid oxidation of the uranium surface presents a serious problem in that it greatly complicates adhesive bonding to this metal.

When a load was applied to adhesive-bonded uranium parts, failure consistently occurred in the mechanically weak oxide layer. It was apparent, therefore, that satisfactory adhesive bonding to uranium required:

(1) Removal of the oxide layer before bonding.

(2) Application of the adhesive to the metal before a new layer of oxide could form.

The oxide layer of uranium can be removed by various physical or chemical methods. Regardless of which technique is used, however, it must include a provision for applying a protective coating of adhesive before a new oxide layer can form. It was theorized that if the oxide layer can be removed and the adhesive applied without exposing the uranium to air, the oxide formation can be greatly reduced and higher strength adhesive bonds will result.

A technique which does just this has been devised for bonding uranium 238.

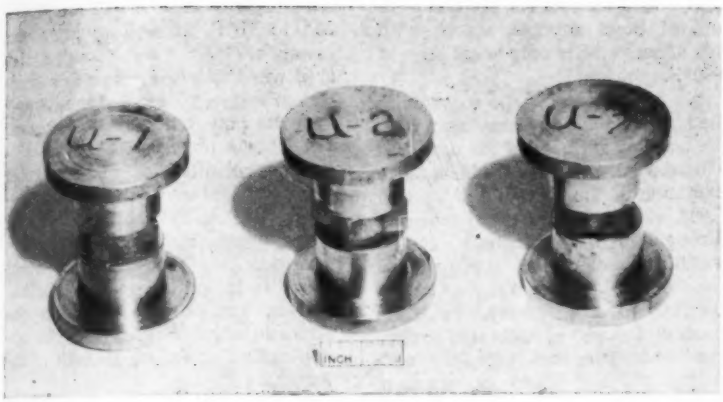
The new technique, which gives excellent results, involves the removal of the oxide layer from the metal by means of abrasion while simultaneously applying the adhesive. This is accomplished by manually abrading the metal in a pool of liquid adhesive. The method not only protects the uranium from contact with the air but also eliminates the possibility of contaminating the surrounding area with the toxic uranium oxide and powdered uranium removed during the abrading process.

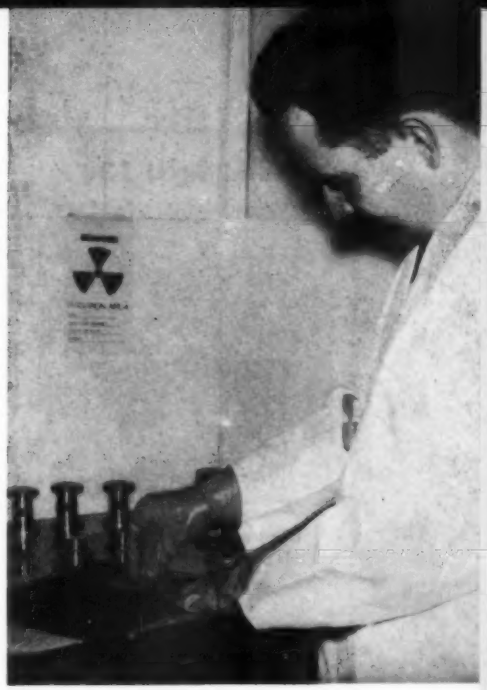
The small amounts of oxide and metal are retained in the adhesive as

Tensile Strengths Obtained When Bonding To Uranium

Adhesive	*Number of Sides Cleaned & Coated*	*Cure Time and Temperature*	*Tensile Strength, psi*
Polysulfide-modified epoxy	Two	Seven days at 73°F.	1640
Polysulfide-modified epoxy	Two	Seven days at 160°F.	100
Polysulfide-modified epoxy	Two	Four months at 73°F.	300
Polysulfide-modified epoxy	Two	Seven days at 160°F. in helium atmosphere	300
Styrene-unsaturated polyester	Two	Seven days at 73°F.	0
Cyanoacrylate type	Two	Seven days at 160°F.	0
Polyurethane	Two	Seven days at 160°F.	950
Polyamide-epoxy	Two	Seven days at 160°F.	1075
Polyurethane	Six	Two weeks at 160°F.	515
Polyurethane	Six	Four weeks at 160°F.	1200
Polyurethane	Six	One year at 25 to 90°F.	1000
Polyamide-epoxy	Six	Two weeks at 160°F.	1200
Polyamide-epoxy	Six	Four weeks at 160°F.	1200
Polyamide-epoxy	Six	One year at 25 to 90°F.	1700

Note: Test temperature—73°F.





► **Test specimens used in determining adhesive bond strength to uranium. Blocks of U-238 are sandwiched in between ASTM button-type steel stensile pieces.**

► **Preparation of adhesive-bonded uranium specimens by the abrasion technique. Note badge worn by the researcher to check maximum safe radiation.**

► **Close-up of the technique used for simultaneously cleaning and coating the uranium 238 specimen by manual abrasion in a pool of liquid adhesive.**

fillers. The liquid adhesive also serves to reduce and remove frictional heat caused by abrasion. Since uranium is pyrophoric when finely divided, this technique ensures safer operations.

Bonds formed by this new method withstood storage for one month at 160°F., and 12 months at temperatures ranging from 25° to 95°F., without loss of tensile strength. In the 12 month storage test both a modified bisphenol A-based epoxy and a polyurethane-type adhesive were found satisfactory for bonding uranium 238, although the bond strengths provided by the former were superior.

In the early attempts to solve the problem of adhesive bonding of uranium the two bonding surfaces were coated with a heavy layer of adhesive and then sanded on a sheet of Number 400 grit sandpaper. During the sanding process the metal surface being abraded was kept constantly under the surface of the adhesive. More adhesive was added as required to keep the uranium surface wet at all times. The bonding surfaces were sanded until a bright metallic finish was obtained. Then more adhesive was applied to the adherend surfaces and the test specimen was assembled.

When specimens were prepared in this fashion using a polysulfide-modified, triamine-cured, bisphenol A-type epoxy, bond strengths of approximately 1200 psi were obtained. With this same adhesive, bond strengths were only 100 psi when the uranium was simply wiped with a toluene-dampened cloth.

When the uranium, abraded and bonded as above, was stored at 160°F. for seven days, the bond strength fell to 100 psi. Specimens prepared by the abrasion method and bonded with a styrene-unsaturated polyester adhesive resulted in 0 psi bonds. The peroxide catalyst used with this polyester-type adhesive apparently contributed to the oxidation of the uranium.

As a result of the great loss of bond strength obtained with the polysulfide epoxy when stored for seven days at 160°F., studies were performed in an attempt to determine the effect of storage up to four months at room temperature on these bonds. It was thought that the loss of bond strength might be due to oxidation that was greatly accelerated by the storage at the elevated temperature of 160°F.

Another test was also conducted to determine if the oxidation could be greatly reduced by storing bonded specimens in an inert atmosphere of helium gas. This was done by placing the freshly bonded test specimens in a chamber which was then purged and filled with helium gas and stored for seven days at 160°F.

It was found in both tests that considerable oxidation of the uranium occurred under the cured layer of adhesive. The cause of the corrosion was not determined but it is possible that the oxide on the unabraded sides of the uranium spread under the adhesive coating. This would be feasible if the active uranium surface attempted to attain an equilibrium state. On the other hand, the polysulfide in the adhesive may have reacted with the metal to form a metallic-sulfide complex.

Handling U-238

Uranium is a hazardous material which must be handled with protective equipment. The 238 isotope used in this study is not as radioactive as U-235.

The surface level radiation emitted from each specimen of the 238 isotope was approximately 10 milliroentgen per hour (mr/hr). Safe handling practice prescribes that the maximum radiation a person can safely be exposed to is 300 mr/wk.

In other studies variations of curing agents and adhesives, and surface primers were used. It was felt that choosing curing agents for the epoxies that were less hygroscopic than diethylene triamine might be beneficial, since water accelerates the oxidation of uranium. The effect of varying the amount of curing agent was also examined. These studies did not result in any satisfactory method of retaining adhesive bond strength to the uranium after prolonged storage.

Since sulfur will unite with uranium, it was decided to evaluate adhesive systems that do not contain polysulfides. The addition of a monoglycidyl ether of cashew nut shell liquid, as a plasticizer or flexibilizer, to an amine-cured epoxy was investigated as well as the use of a polyamide flexibilizing hardener with the epoxy. The flexibilizers were used to distribute stress more uniformly in the bonded joint when a load was applied.

Cyanoacrylate and polyurethane type adhesives were also evaluated. Since the cyanoacrylate adhesive depended upon atmospheric moisture for initiating its polymerization and cure, the moisture absorbed by the adhesive undoubtedly helped catalyze oxidation of the uranium surface. This would account for the complete loss of bond strength shown with this adhesive after only seven days at 160°F.

An attempt was made to vacuum metallize a coating of aluminum onto the bonding surfaces of the uranium. This did not solve the problem since oxidation of the very thin aluminum layer allowed oxygen to penetrate through to the uranium. Vacuum metallizing of nickel onto all six sides of the uranium was also unsuccessful. In both cases, oxidation caused failure of adhesive-bonded specimens prepared with the vacuum-metallized blocks of uranium.

The polyamide-epoxy combination and the polyurethane adhesives gave the most promising results obtained in these studies. However, the problem of oxidation after bonding and during storage remained. It was noted that during storage of the specimens, the oxide layer from the oxidized unbonded sides would gradually spread under the adhesive layer and would eventually weaken the bond. The spread of such oxidation would be somewhat analogous to the spread of corrosion of steel under a chromium-plated surface that has been ruptured.

The analogy of the oxidation of uranium to that of ruptured chromium-plated steel suggested the possibility that if a cube of uranium were cleaned free of oxides and then encased in a film of plastic, the decreased contact of the metal with air would reduce the subsequent formation and spread of oxidation on the uranium surface.

It was this technique which finally made possible effective adhesive bonding to uranium. In the later attempts to bond uranium, sanding all six sides instead of only the two bonding surfaces while in the pool of adhesive made it possible to obtain a bonded specimen in which the only oxygen to contact the uranium was that trapped in the adhesive and that which would penetrate the adhesive film.

By using the method of simultaneously cleaning and coating each of the six sides of the uranium block, specimens were prepared in which the adhesive bond strengths after 12 months at temperatures ranging from 25° to 90°F., were equal to or greater than the bond strengths obtained after 12 days cure. Other specimens were prepared by this method which withstood one month storage at 160°F., without losing any of their original strength.

This retention of original adhesive bond strength after the 12 months at 25° to 90°F. as well as after one month at 160°F. was found attainable with both the polyamide flexibilized and cured epoxy adhesive and with the polyurethane-type adhesive.

Each specimen used in these evaluations consisted of a rectangular block of uranium sandwiched between two ASTM button-type steel tensile pieces. It should be noted that uranium 238 is a very hard metal which is difficult to machine. Scatter of test results obtained with the bonded uranium specimens is undoubtedly due to one or both of the following reasons:

(a) Non-parallelism of the bonded surfaces of the uranium due to the difficulty of cutting the blocks as well as to the repeated manual abrasions during preparation of test specimens.

(b) Poor centering of the uranium blocks in preparing the sandwich-type adhesive specimens. This would result in unbalanced bonded assemblies which might cause a cleavage effect when a load is applied. Failure would then result at lower loads.

Note: The investigation described in this article covers the results of only a limited amount of laboratory work. Because of the unusual nature of the program, however, and the unique properties of the adherend, it was decided to publish the information obtained.

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....Continuous Adhesive Application Techniques.....

Accurate control of uniformity in adhesive applications is a requirement where volume and quality are desired

Most present day industrial adhesive application processes have not kept step with technological developments in adhesive formulation, or with the ingenuity displayed in new adhesive uses. Many patents have been issued and millions of research dollars have been spent in the development and improvement of adhesive compounds that are being applied today by the crude techniques of earlier centuries. Ingenious new geodesic architectural structures, employing honeycomb reinforcements or air inflation supports, are fabricated by the use of adhesive application techniques that were common in the natal stage of plywood development.

A review of application or coating processes cannot be classified with reference to the chemical identification of adhesives, such as cellulosics, phenolics, rubber, protein, etc. It must be based on their physical classifications, such as lacquers, latices, hot melts, etc. The basis for this resolution is recognition of the rheological idiosyncrasies of the various film-forming adhesives.

Adhesive application by hand brushing or by trowelling may be expedient in limited usage but, for volume production operations, a more accurate control of uniformity is required for quality and to avoid waste. A brief listing of a few typical products requiring continuous adhesive application will indicate the range of problems that have to be met with a significant degree of "commercial uniformity."

Products Requiring Application

(a) Heat sealing cellophane may carry thermoplastic or adhesive coating of .0001-inch thickness on one or both sides.

(b) Fiber glass fabric or nonwoven mat may be coated or impregnated with thermosetting resins for aircraft construction to meet exacting specifications for uniformity and weight.

(c) Pressure-sensitive adhesive tapes require accurate metering of rubbery or dough-like adhesive compounds.

(d) Remoistening paper tapes require precise coating of water-thin adhesives at speeds approximating 1000 feet per minute.

(e) In the lusty market for decorative and functional package wraps, it is necessary to laminate .00035-inch aluminum foil to a paper base with precise control of initial-tack adhesives at a speed of approximately 1000 feet per minute.

For the purpose of this discussion, the various adhesive application processes may be divided into two groups:

(1) Application of excess adhesive to the surface with subsequent partial removal.

(2) Premetering of the adhesive prior to application to the surface.

The most universally used method of removing excess adhesive is by scraping the surface with a bar or "knife". Variations of this technique are the knife-over-roll coating, knife-on-blanket coating, and floating knife coating. Figure 1 shows a knife-over-roll coating unit, which is used for the application of rubber adhesive. Control of uniformity of application involves manipulation of web tension, speed, adhesive viscosity, and angle of contact with the coating knife. Many variations of coating knife contour permit operation with a range of adhesive flow characteristics and viscosities.

Equipment and Processes for Adhesives Application

KNIFE-OVER-ROLL COATING

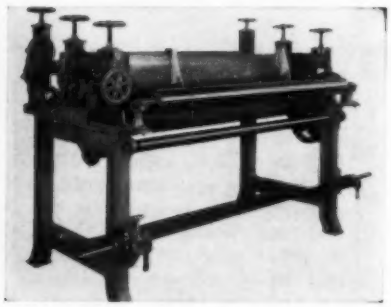
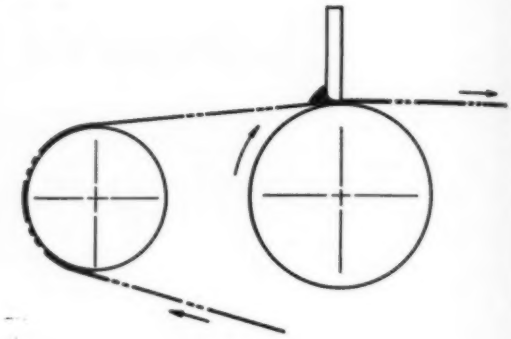


FIG. 1. In this unit, excess adhesive is scraped off surface with bar or knife.



SQUEEZE ROLL COATING

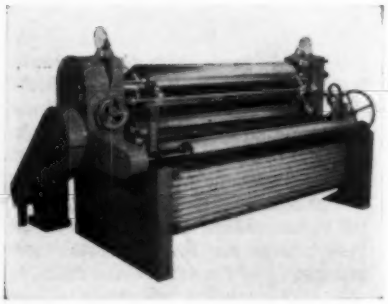
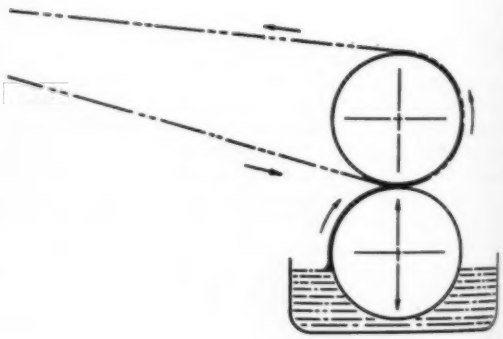


FIG. 2. Passage against a metering roll removes adhesive excess in unit above.



AIR KNIFE COATING

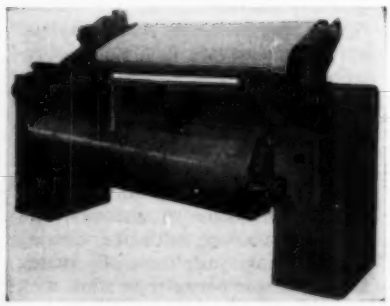
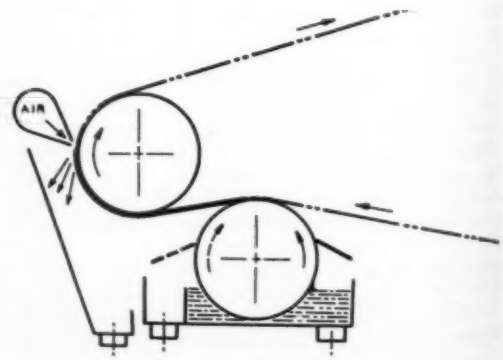
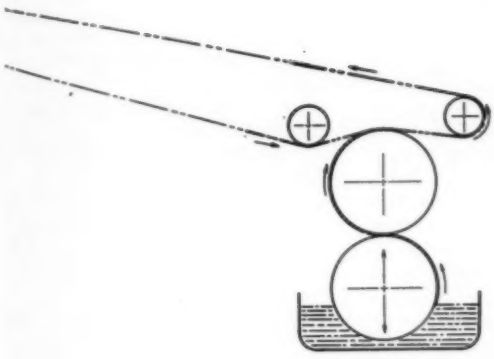


FIG. 3. A precisely controlled flat air jet monitors adhesive coat thickness.



KISS ROLL COATING



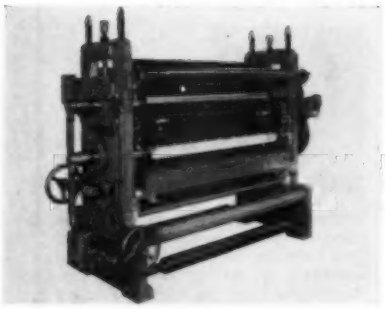


FIG. 4. Kiss roll unit is commonest means of premetering coating before application.

ENGRAVED ROLL COATING

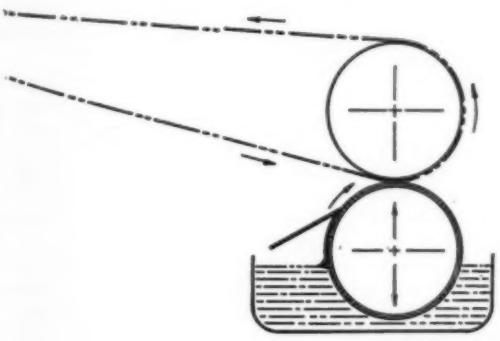
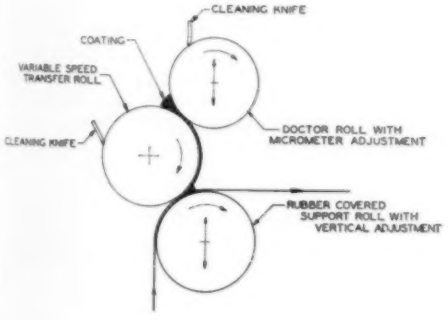


FIG. 5. In unit shown above, adhesive is measured by indentations in coating roll.

REVERSE ROLL COATING



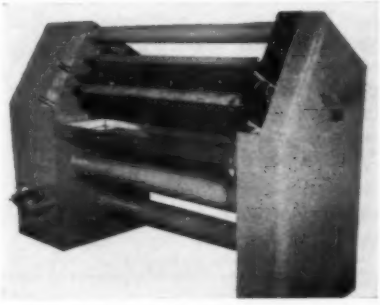
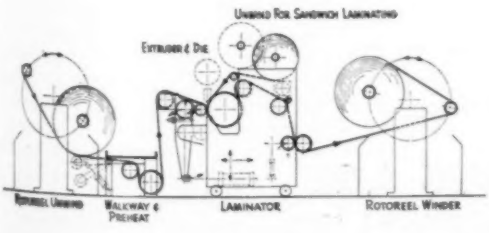


FIG. 6. Adhesive application is controlled here by spacing between the unit's rolls.

EXTRUSION COATING



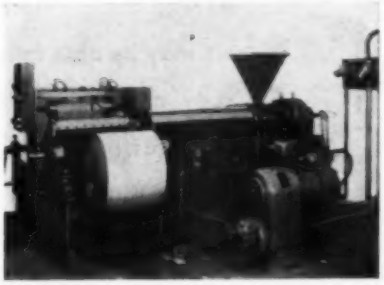


FIG. 7. Premetered adhesive is applied to a continuous web by extrusion from a flat die.

About the Author . . .

DALE G. HIGGINS is director of sales of the Waldron-Hartig Division, Midland-Ross Corp. Prior to joining the company, he was associated with DuPont and Pantasote. He has handled sales of machinery for coating, laminating, etc. Mr. Higgins is on the Editorial Advisory Board of *Adhesives Age*.

Another widely used method to remove excess adhesive is by passage against a metering roll. This method is commonly called squeeze-roll coating, and Figure 2 shows a squeeze roll coating machine constructed with precision chilled iron coating rolls. Uniformity of control of adhesive thickness is limited by variations in the thickness of the base web and by the precision of the metering rolls.

The use of a precisely controlled flat air jet operating close to the coating surface is another method for the removal of excess adhesive from the web surface. Figure 3 illustrates the operating principle of this technique, which is called air knife coating. This system is particularly well suited for the application of latex adhesives to the back of carpeting as it distributes the coating uniformly on the high and low surface areas without wasting latex in the low "pockets" of the backing.

The "dip and flow" or gravity method for the removal of excess adhesive is too limited to merit discussion.

The most common method for premetering adhesive coating prior to application is kiss coating. Figure 4 shows a precision kiss roll coater used for application of remoistening (dextrine) adhesive to paper. When one or both of these rolls is rubber covered, then the accuracy with which the coating is metered is dependent on the rubber hardness, as well as on the roll pressure, speed, coating viscosity, etc. Furthermore, not all the coating is removed by contact with the web, so that the adhesive film is split at this point, with possible resultant stippling effect. The use of precision rolls, bearings and controls improves the accuracy of the kiss roll coater.

Web Application

Engraved roll coating is another method for premetering adhesive for web application. Figure 5 shows a machine suitable for engraved roll adhesive application of a hot melt adhesive. In this method, the amount of adhesive brought into contact with the web is measured by the amount of engraving or indentations in the coating roll.

The most universally used premetering method for the precision control of adhesive application is reverse roll coating. The reverse roll coater shown in Figure 6 is used in applying polyester adhesive to a fiber glass fabric for aircraft work. The amount of adhesive applied is controlled by the spacing or clearance between the precision rolls. Roll run-out or tolerance is .0001-inch. Another quantitative control of adhesive application is by regulation of the relative coating roll speed in relation to web speed. Variations in viscosity or flow characteristics can be compensated by adjustment in rate of revolution of the top metering roll.

The latest technique for the application of premetered coating to a continuous web, or to sheets, is by extrusion from a flat die. This process is called extrusion coating, and Figure 7 shows a laboratory scale extrusion coater. Although the process has long been used in casting photographic film, and more recently in applying polyethylene resin to paper, it is now being widened in scope by studies of the behavior of hot plastisol adhesives.

Many pages of explanation and description could be written about each type of adhesive applicator or coater. There are many refinements that have been developed to assist in specific adhesive problems. One of the most important factors to consider in the selection of an adhesive coater is the accuracy of its construction and of its controls. There may be as much difference in machine performance, due to precision of design, as there exists between the old fashioned sky-rocket and today's guided missile. For uniformity of product, and for control of adhesive waste (avoidance of excesses), the initial cost of the proper adhesive coater can be amortized in a sufficiently short time to conform to the most stringent investment requirement.

Have a *PROBLEM?*

As who doesn't these days. However, if it is a problem involving adhesives, we may be able to help. Drop us a line explaining the nature of your difficulty and we will try to obtain an answer for you. All you need do is address:

Editor: ADHESIVES AGE
101 West 31st Street, New York 1, N. Y.

NEWS of the

ADHESIVES WORLD

137th Annual A.C.S. Meeting Features Adhesion Symposium

Ten papers were presented at the Symposium on Adhesion on April 6, during the 137th Annual Meeting of the American Chemical Society, which was held on April 5 to 14 at the Hotel Sheraton-Cleveland in Cleveland, Ohio. John E. Rutzler, Jr. (Case Institute) presided over the adhesion symposium, which was sponsored by the ACS Division of Chemical Marketing and Economics. Over seven thousand chemists and chemical engineers attended the ten-day national meeting of the ACS, at which 1,122 papers were read at sessions sponsored by 20 ACS divisions. Abstracts of the ten papers presented at the Symposium on Adhesion follow:

A Study of Reactive Diluents in Aromatic Amine-Cured Epoxy Adhesives, *by C. A. May and A. C. Nixon (Shell Development).* A number of different epoxy compounds were studied as reactive diluents for viscosity control in aromatic amine cured epoxy paste adhesives. The compounds contained aromatic and aliphatic glycidyl ether groups, glycidyl groups, an epoxy ethyl groups, and epoxy groups on the cyclohexane ring. It was found that both cross-linking density (functionality) and this type of epoxide group had a pronounced effect on bond strength. In general, higher functionality led to better bond strength at elevated temperatures. Compounds containing glycidyl ether groups generally gave satisfactory performance. Epoxy cyclohexyl derivatives, with one exception, gave poorer results, probably due to slow curing reaction rates.

Measurement of Adhesion by a Blister Method, *by Hans Dannenberg (Shell Development).* An instrument for measurement of adhesion of organic coatings has been developed. It is based on the formation of a blister by injecting a liquid (mostly mercury) under pressure between the coating and the substrate. Design and operation of the instrument are described, an evaluation of its performance and limitations is given, and examples of its application are presented. The method should be useful for accurate measurement of adhesion of many types of surface coatings to metal and, possibly, other substrates as well as for studies of the various factors that influence adhesion.

Some Interactions of Externally and Internally Derived Stresses in Crossed Grain Wood Adhesive Joints, *by Alan A. Marra (University of Michigan).* As a means of exploring adhesive-adherend interactions in glued wood constructions, the cross-lap specimen appeared to possess certain characteristics which allowed manipulation of some specimen factors independently of bond quality variables. Such factors are useful in experimental methodology to help discount undesirable side reactions which affect strength observations in a manner unrelated to the bond quality relationships sought. The independent factors investigated in the work reported included block thickness, bond area, and post-gluing moisture content. These "specimen factors" were studied in combination with "bond quality factors" to determine what, if any, relationships existed.

Theory and Analysis of Peel Adhesion: Rate-Temperature Dependence of Fiscoelastic Interlayers, *by D. H. Kaelble, (Minnesota Mining & Mfg.).* A theoretical treatment has been developed which concerns the magnitude and rate-temperature dependence of peel force for bonds comprising viscoelastic adhesion interlayers. From "master curves" of the inter-layer dynamic moduli and ultimate stress or strain one may calculate a peel force "master curve." The shift factor (a_T) utilized to superimpose transient or dynamic rheological response and ultimate properties of high polymers is applied to superimpose peel data measured at different temperatures. Experimental and theoretical peel force "master curves" are presented.

Forces in Coatings Removal by the Cutting Mechanism, *by W. K. Asbeck, R. H. Peterson, and R. D. Jenkinson (Union Carbide Chemicals).* A detailed analysis of the interaction of the knife and coating during assessment of practical adhesion by knife cutting methods is made. It is found that the knife angle (rake angle) exerts a major influence on the coatings removal process. The

mathematical relationships between the various force vectors are derived and the effects of rake angle, friction angle and shear angle are pointed out.

Structural Bonding of Polyolefins, *by Richard G. Baker and Arthur T. Spencer (Bell Telephone Laboratories).* The project of developing structural bonds between beryllium copper and low density polyethylene was undertaken to provide thoroughly reliable seals for submarine cable applications. In these applications where extremely high pressures are involved and the cost of repair is prohibitive, no available bonding techniques were satisfactory either because of low bond strength or cold flow in the bond and an entirely new approach had to be developed. The new method depends on the chemical formation of a cupric oxide layer on the metal with subsequent bonding of polyethylene in a short-time, high-temperature molding operation using no intermediate adhesive layer.

Effect of Polymerization Variables on the Strength of Bonding of Copper, Aluminum, or Nickle, with Poly(Methyl-methacrylate), *by Edward L. Kern, K. Monica Park, Joseph Gaynor, Edward G. Bobalek and Selby M. Skinner (Case Institute).* The increase in bond strength obtained by the partial preliminary polymerization of certain thermoplastic adhesives is exhibited by experiments with methyl methacrylate, using various metal adherends. The metal acts as a polymerization retarder, and polymerization of the adhesive prior to contact with the metal increases the strength of the bond. The effect of polymerization schedule upon the nature of a free polymer surface or the strength of an adhesive bond is discussed.

Types of Bonds Involved in Adhesion of an Epoxy Resin to Steel and Aluminum, *by George J. Barenholtz, I. C. Chu and John E. Rutzler, Jr. (Case Institute).* An epoxy resin, 3, 4-epoxy-6-methylcyclohexylmethyl 3, 4-epoxy-6-methylcyclohexanecarboxylate cured with maleic anhydride and trimethylol propane, was heated to different temperatures in an apparatus in which the amount of gas evolved at various temperatures was measured and then analyzed by means of a mass spectrograph. Measurements and analyses were made on the unfilled resin and the resin filled with aluminum, aluminum oxide, and steel in separate experiments. The results obtained are interpreted to mean that free radicals are formed during curing and that they form chemical bonds with metallic adherends. The ester linkages of epoxy resins probably are chemisorbed by oxides in metal surfaces.

Adhesion and the Surfaces of Mechanically Ruptured Polymers, *by Hideshi Sato and John E. Rutzler, Jr. (Case Institute).* The relatively stable free radical, diphenylpicrylhydrazyl was employed to test for the formation of free radicals when polyethylene, polytetrafluoroethylene, polyvinylchloride and films of two adhesives were cut mechanically. Free radicals were produced in different quantities by mechanical disruption of the polymers. With both an epoxy and a butadiene-acrylonitrile-phenolic resin, shear and peel strengths, respectively, were found to be related to the number of free radicals formed upon rupturing the bonds. The evidence obtained in this investigation indicates that epoxy resins are chemisorbed on some adherends and that adhesion to abraded surfaces of resins involves a chemical reaction when free radicals are present in the adhesive during cure.

Evaluation of the Factors Affecting Adherometer Adhesion, The Work of Removal, of Organic Coatings, *by L. Reed Brantley (Occidental College).* The type of adhesion measured by the Adherometer, and other test instruments designed to remove an organic coating from a substrate, is a shearing action in the coating which removes all but a very thin film. The term "hesion" has been proposed in order to distinguish this action from one which might disrupt the true bonds of adhesion at the interface. In order to compare different methods of hesion measurement as well as to compare different organic coatings, the concept of force of adhesion is replaced with the more realistic "work of hesion," the work required to remove unit volume of the coating. The results are given of an evaluation of factors affecting the work of "hesion" of plasticized nitrocellulose and ethylcellulose coatings on aluminum and glass.

R. L. Rasmussen

Named by Union Carbide

Ronald L. Rasmussen has been appointed assistant regional manager of the South Atlantic Region of Union Carbide Plastics Co., New York, N.Y., and will supervise the sale of Bakelite brand polyethylene, phenolic, styrene and vinyl resins and compounds for molding, extrusion and film and sheeting applications. He will be located at the company's Moorestown, N.J. office. Mr. Rasmussen graduated from Stevens Institute of Technology in 1951 with a B.S. degree in mechanical engineering. Since 1954 he has been a technical sales representative covering the New Jersey area. He is a member of the American Society of Mechanical Engineers and the Society of Plastics Engineers.

Narmco Changes Name

Narmco Resins & Coatings Co., Costa Mesa, Calif., has changed its name to the Narmco Materials Division of Narmco Industries. The parent company, located in San Diego, Calif., recently became a wholly-owned subsidiary of Telecomputing Corp., Los Angeles, Calif. The division's new name was chosen as being more descriptive of its activities. The former Narmco Resins Co. was established in 1952 and develops and manufacturers structural adhesive systems, reinforced plastics and structural laminating materials, sandwich core materials, thixotropic putties, resins, coatings and sealants.

FMC Plans Research Unit

The Central Engineering Laboratories of Food Machinery & Chemical Corp., located in San Jose, Calif., will begin construction of a new research and engineering center on about July 1. The initial phase of the center, to cover over 40,000 square feet, will house laboratories, engineering and administrative offices. It will be located in Santa Clara adjacent to the present FMC San Jose facilities.

Auto Show Includes Plastic-Bodied Cars

Two models among the 311 on display at the Fourth International Automobile Show on April 16 to 24 at the Coliseum in New York City featured fiber glass bodies. The models are the Chevrolet Corvette (ADHESIVES AGE, March, 1959) and the Simca Fulgur.

On exhibit at the Show, which drew a larger attendance than last year's 250,000, were compacts, economy cars, sports cars, station wagons, luxury models, experimentals and commercial cars from the United States, Czechoslovakia, England, France, Germany, Holland, Italy, Japan, Sweden and the Soviet Union. The exhibits were housed in more than 250,000 square feet of space on four floors of the Coliseum.

Also represented were an unprecedented number of manufacturers of automobile accessories, showing tires, batteries, air conditioners, FM radios, superchargers, carburetors, waxes and polishes, spark plugs, tools and mufflers. Exhibits by allied fields were also on display.

Colton Building Plant

Colton Chemical Co., Cleveland, Ohio, has announced that it will build a new resin plant at City of Industry, Calif., on a five-acre tract purchased recently. Facilities will include a sales office, technical service laboratory, and a warehouse to replace a bulk terminal now operated in Los Angeles. The plant, to be completed later this year, will be devoted to resin polymerization and will produce Colton's Flexbond and Vinac resins, used in the formulation of paints, adhesives, and paper coatings. The company will also maintain complete warehouse stocks of Vinol polyvinyl alcohol and other specialty products at the new location.

National Starch Earnings

Consolidated sales for National Starch and Chemical Corp., New York, N.Y., for the first quarter, ended March 31, were $13,429,231, as opposed to $12,374,035 in the first quarter of 1959. Net income after taxes was $759,003, compared to $692,315 for the like period in 1959. Earnings per common share of stock were 37¢, compared to 34¢ in the first quarter last year, computed after adjusting shares for a 2-for-1 stock split on May 7, 1959, and a 2 per cent stock dividend effective March 10, 1960.

H. E. Weingartner

W. A. Weaver

Arabol Elects New President

Arabol Manufacturing Co., New York, N.Y., has elected Henry E. Weingartner, former executive vice-president, to the post of president. William A. Weaver, former president, has been elevated to the post of chairman of the board. In reviewing the company's record for 1959, Mr. Weaver reported sales "in excess of $8 million" for the privately-owned firm.

Mr. Weingartner graduated from Brooklyn Polytechnic Institute in 1931 with a B.S. degree in chemistry. He has done post-graduate work at New York University School of Commerce and Business Administration. He joined Arabol in 1931 as a chemist and has spent his entire business career with the company. In 1938 he was made plant manager of the firm's Brooklyn plant, and he served as export manager from 1946 to 1953, expanding company sales to Latin America, South Africa, New Zealand and Australia. In 1953 he became a vice-president and was put in charge of sale and development of special products, serving in this capacity until he was named executive vice-president in 1957.

In addition to being chairman of the board, Mr. Weaver is a director of the Arabol Manufacturing Co., Ltd., a wholly-owned English subsidiary. He attended New York University, majoring in finance and economics. From 1926 to 1934 he was treasurer of the Morris Plan Corp. of America. He has also been associated with the Chase Manhattan Bank and the Rockefeller Foundation. From 1934 to 1938 he was treasurer of the Electric Home & Farm Authority, an independent corporate agency of the U.S. Government. He joined Arabol in 1938 as treasurer, and was elected president in 1943.

Formica Laminate Press

A new plastic laminate press, said to be the world's largest, has been installed at the Evendale, Ohio plant of Formica Corp. The press has been cited as an indication of the growing use of laminated plastics as a major surfacing material in construction. It weighs 300 tons, has a 7,000 ton clamping pressure capacity, and will produce plastic laminated sheets in sizes as large as 5 by 12 feet.

New SSAMPE Officers

The Southwest Society of Aircraft Materials and Process Engineers has elected its new officers for 1960-1961. The newly-elected officers are: *President*, Sam C. Aker (Bell Helicopter); *Vice-President*, Jack Browne (Chance Vought); *Secretary*, Robert Norton (Chance Vought); *Treasurer*, Jess Harwell (Adco Industries); *Parliamentarian*, Harold Owen (Convair).

Packaging for Profit

Theme of Packaging Conference

More than 25,000 visitors viewed displays showing the latest in adhesives, packaging machinery, materials, supplies, containers and services, which were exhibited by 333 firms at the American Management Association's 29th National Packaging Show on April 4 to 7 at Convention Hall in Atlantic City, N. J. Running concurrently at Convention Hall with the first three days of the Packaging Show was AMA's annual National Packaging Conference. The theme of the 1960 conference was "Packaging for Profit," which was the topic discussed at the opening session. Other topics covered at the convention were "Package Production," "Package Research," "Package Marketing," and "The Profiles of Packaging."

At the Packaging Show, adhesives, pressure-sensitive tapes and gummed tapes for use in packaging were displayed by 28 firms. Mark Andrews Co., Inc., Chicago, Ill., displayed its line of 1960-model flexographic pressure-sensitive tape and label printing equipment. A full line of specification adhesives for packaging production line use was shown by Arabol Mfg. Co., New York, N. Y. Pressure-sensitive labels, including its new FABric labels and labeling equipment was in the booths of Avery Label Co., Monrovia, Calif. The exhibit of Brown-Bridge Mills, Inc., Troy, Ohio, had its flat-as-a-pancake gummed label paper and Red Streak gummed tapes. F. G. Findley Co., Milwaukee, Wisc., had a joint exhibit with Southern Adhesives Corp. and Union Paste Co., which featured a wide range of adhesives and packaging examples using the adhesives.

H. B. Fuller Co., St. Paul, Minn., exhibited its line of new adhesives used by packaging firms. Hampton Mfg. Co., New Rochelle, N. Y., displayed its Blue Cross pressure-sensitive paper and cloth tapes, packaging tapes, printable paper tapes and tapes meeting government specifications. Able-Stik pressure-sensitive, heat-seal, water-activated gummed and ungummed labels were shown by Allen Hollander Co., Inc., New York, N. Y., as well as its new two-way pressure-sensitive label dispenser. A pressure-sensitive blister that can be applied to merchandising cards without special equipment, and all types of pressure-sensitive labels were on exhibit by Jackmeyer Corp., New York, N. Y. Dutch Brand Division of Johns-Manville showed filament-reinforced and paper strapping tapes, a full line of pressure-sensitive cloth and paper packaging tapes, and rubber-base adhesives.

Industrial pressure-sensitive tapes including its cloth packaging tapes, were shown by Polyken Sales Division of Kendall Co., Chicago, Ill. Kleen-Stik Products, Inc., Chicago, Ill., exhibited its line of label stocks including tamper proof labels and pressure-sensitive adhesive stocks, as well as its Model 100 label applicator. Linear Products, Inc., had on display printed pressure-sensitive tapes and labels and dispensing equipment for the line. Samples of adhesives for such difficult surfaces as acetate, cellophane, Mylar, polyethylene, vinyls and other plastics were shown in the booth of Manhattan Adhesives Corp., Brooklyn, N. Y. Minnesota Mining & Mfg. Co., St. Paul, Minn., showed for the first time a new tape to replace cellophane tapes for industrial use in addition to its industrial tapes, polyester film ribbons, chemical products and gummed paper line.

Wide Range Exhibited

Morningstar-Paisley, Inc., New York, N. Y., had as its exhibit theme "Adhesives of All Types for Every Packaging Operation," and displayed its range of packaging application adhesives. A display of pressure-sensitive tapes, pressure-sensitive print stocks and label stocks, bulk adhesives, coatings and sealers was featured by Mystik Adhesive Products, Inc., Chicago, Ill. The booth of National Starch & Chemical Corp., New York, N. Y., stressed adhesives for flexible packaging and laminating, as well as hot melt and pressure-sensitive types for coatings and tapes. Among the products shown by Permacel, New Brunswick, N. J., were Strap-It Tight band tape, printable metallized Mylar tape, cellophane tape, a complete line of adhesives for all packaging or sealing operations, and dispensing equipment. Pyroxylin Products, Inc., Chicago, Ill., distributed literature on the use of lacquer and hot-melt packaging materials, including adhesives, protective coatings and adhesives for blister packaging.

A method of manufacturing pressure-sensitive labels from roll label stock was shown by Simon Adhesives Products Corp. In addition to showing special adhesives for food packaging, Stein, Hall & Co., New York, N. Y., displayed adhesives having special characteristics for other requirements, with emphasis on water-proof adhesives. The booth of Swift & Co., Chicago, Ill., contained high-speed resins for packaging, new high-heat resistant laminating adhesives, packaging adhesives for the canning industry, case-sealing adhesives and palletizing adhesives. Technical Tape Corp., New Rochelle, N. Y., exhibited its complete line of industrial and electrical tapes, and its new line of retail tapes, including pressure-sensitive labels and a label dispenser. Tompkins Label Service, Philadelphia, Penna., had on exhibit its pressure-sensitive, heat-seal bag headers, gummed and ungummed labels, as well as labels for high-speed automatic equipment. York Tape Printers, Inc., York, Penna., displayed its line of printed pressure-sensitive tapes and die-cut labels, and its dispensers for industrial and commercial use.

Adhesives in packages played a prominent part in the exhibits of many companies who displayed tape and sealing equipment. Amsco Packaging Machinery, Inc., Long Island City, N. Y., exhibited its label appli-

Help Sought

A section on bookbinding adhesives of Subcommittee V on Specifications, Committee D-14 on Adhesives of the American Society for Testing Materials is seeking persons who would be interested in joining the Bookbinding Section and assisting in drafting a method of test. Those interested should contact Marco Petronio, Chief, Fluids and Lubricants Section, U. S. Army Ordnance, Frankford Arsenal, Philadelphia 37, Penna.

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WHIRLING HELICOPTER BLADES, bonded with B.F.Goodrich adhesives, are lighter, stronger, and better balanced.

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TODAY, B.F.Goodrich makes over 200 kinds of structural adhesives. These adhesives can permanently fasten metals, plastics, ceramics, glass —almost anything—to themselves or each other. In supersonic planes, car brakes, curtain wall panels, whirling helicopter blades, for example, adhesive bonding has proven to be stronger and safer than conventional fasteners.

New uses for high-strength adhesives are constantly being developed as we work with customers to find ways to improve product designs and assembly methods. If you mass-produce a product and think adhesive bonding might improve it, please write and give us full details. *B.F.Goodrich Industrial Products Co., Dept. M-844, Akron 18, Ohio.*

B.F.Goodrich

cator attachment. Manual and electric dispensing machines for gummed and pressure-sensitive tapes were displayed by Better Packages, Inc., Shelton, Conn. Biner-Ellison Machinery Co., Los Angeles, Calif., exhibited its Filabelmatic, Labelmatic and Feedomatic labeling machines. Lever and electrically operated pressure-sensitive label dispensers and automatic product labeler with new coding attachment were shown by Derby Sealers, Inc., Derby, Conn. Lever Mfg. Co., New York, N. Y., had on display a completely automatic slitting machine for pressure-sensitive tapes and plastic film of all types. Its latest sealing tape dispensers with samples of Itstix plain and printed sealing tapes, strapping tape, reinforced plain and printed tapes, and labels for shipping, inventory and identification were shown by Nashua Corp., Nashua, N. H. Potdevin Machine Co., Teterboro, N. J., exhibited examples of its line of gluing machines, including a label paster with semiautomatic feeder, ductor roller margin gluer, coating machine, topside margin gluer, hot-melt seam extruder and semiautomatic labeler. Soabar Co., Philadelphia, Penna., displayed automatic marking equipment for roll tickets and labels, including pressure-sensitive, heat-seal, gummed and ungummed, and various tag stocks.

Carborundum Meeting

Distributors from the Cleveland area met with sales management personnel of the Bonded Abrasives and Electro Minerals Divisions of the Carborundum Co., Niagara Falls, N.Y., at a recent three-day conference at the Wade Park Manor Hotel in Cleveland, Ohio. Presentations covering the full range of grinding wheels and abrasive grains, catalogs, sales training, appraisals, and inventories, were geared to increasing distributor sales in 1960. The company reports that it is stepping up its distributor relations program with a series of this type of field meetings.

Mereco Cleanup Products

The Mereco Products Division of Metachem Resins Corp., Cranston, R.I., has announced two products to be used for cleanup of epoxy and polyester resins. They are Meta-Terge 1405, a cleanup detergent for uncured epoxy and polyester resins, and Meta-Strip 702, a synergistic, non-corrosive solvent for removing and stripping cured epoxy resins.

T. E. Holdridge

Appointed by Narmco

Thomas E. Holdridge has been appointed Eastern region sales manager of the new East Coast sales headquarters of Narmco Materials Division, formerly Narmco Resins & Coatings Co., Narmco Industries, in Garden City, L.I., N.Y. He was formerly technical field sales manager at the division's home office in Costa Mesa, Calif. A large part of Mr. Holdridge's time will be devoted to the exploration of new markets for Narmco's structural materials. A graduate engineer from the University of Michigan, he joined the Narmco Materials Division in 1957 as a technical sales representative and brings to his new position almost ten years of experience in the fields of plastics, adhesives, and structures.

Goodyear Sales Gain

A 15 per cent first quarter sales gain in packaging films, reflecting a gain of 32 per cent over first quarter sales in 1958, has been reported by the Goodyear Tire and Rubber Co., Akron, Ohio. A. F. Thomas, Films & Flooring sales manager, said that the company's fast start should pave the way to a new sales record this year, and that the packaging films industry is expected to increase in volume by approximately 10 per cent. He claimed an over-all film capacity increase of more than 40 per cent due to Goodyear's entry into the field.

Armour Adhesives Plant

A new 15,000 square foot industrial adhesives plant in Philadelphia, Penna., has been opened by Armour Alliance Industries, Alliance, Ohio. The plant, the third industrial adhesives facility built by Armour in the past year, will manufacture animal-base, resin-base, vegetable-base, and blood adhesives.

Circuit Materials Formed

A new firm, Circuit Materials Corp., New Brunswick, N.J., has been formed and will specialize in adhesive coated copper foil products used in the manufacture of printed circuits. Printed circuits find application in the manufacture of such products as radios, television sets, computers, automobiles, and home appliances. The new company has acquired the adhesive coated copper foil business previously handled by the Permacel Division of Johnson and Johnson, New Brunswick, N.J.

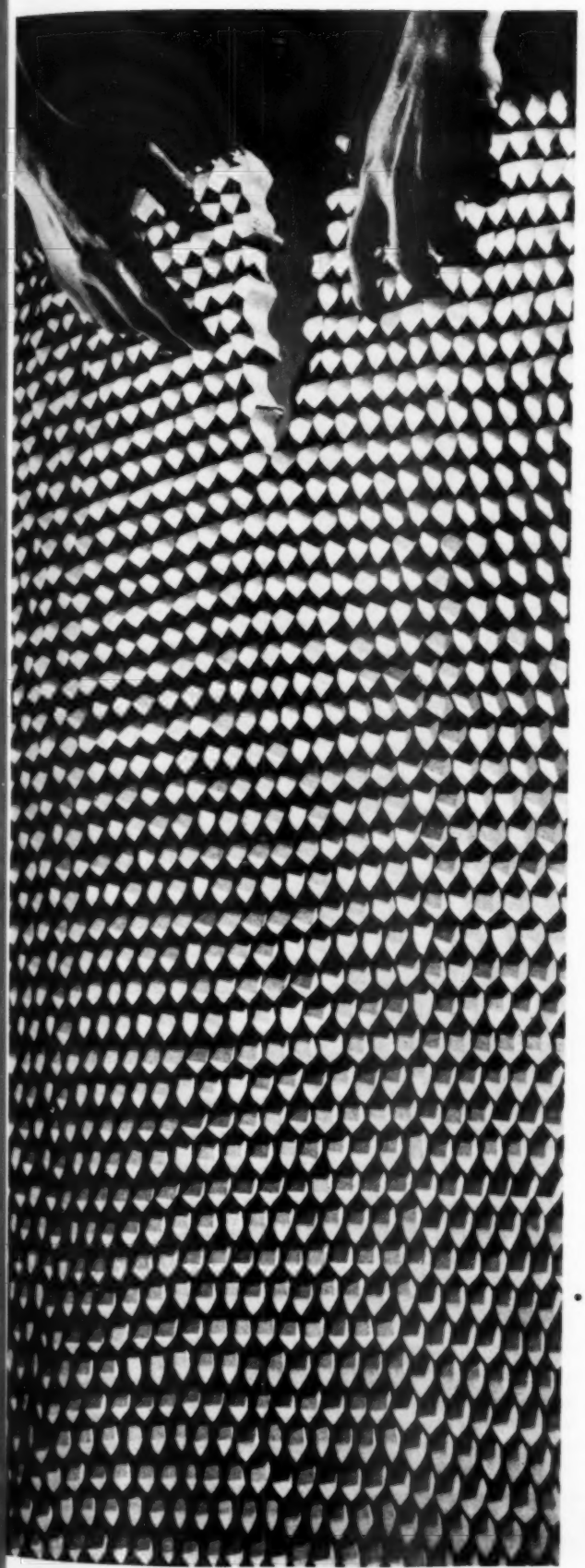
The line of products includes a coated copper foil known as Permacel 195 which is said to combine features hitherto unattainable in a single adhesive coated copper foil: excellent bond strength, high heat resistance and resistance to chromic acid and cyanide plating solutions, and excellent electrical characteristics. It can be used in manufacturing popular grades of copper clad board and for bonding of a variety of metal surfaces. Dr. Steven J. Karwan, president of the new company, was formerly Permacel's product manager for adhesive coated copper foil products.

3M Unit Ceramics Plant

American Lava Corp., Chattanooga, Tenn., a subsidiary of Minnesota Mining & Manufacturing Co., will build a 50,000 square foot technical ceramics plant at Laurens, S.C. Construction will begin as soon as final arrangements have been completed with local officials, and production is expected to begin in the first half of 1961. American Lava has a technical ceramics plant at Chattanooga, and the Laurens plant is part of a 3M program to develop at least two manufacturing points for each major product line, according to the company.

FMC Names Farno

Glenn A. Farno has been named sales manager for chemicals in the Chemicals & Plastics Division of Food Machinery and Chemical Corp., New York, N.Y., and will have responsibility for sales of all the division's products except Dupont and Oxiron resins. Formerly sales representative for the division, he joined FMC in 1952 and was assigned to the West Coast sales area, transferring to New York in 1958. He is a graduate of Duke University and a member of the Society of the Plastics Industry.



Schenectady Phenolic Resins Add Permanence and Strength to

PAPER HONEYCOMB ADHESIVES

In natural, nitrile or neoprene-based industrial adhesives, Schenectady modified phenolic resins increase adhesion, improve aging, heat, and moisture resistance — important features for stronger, longer lasting paper honeycombs. Note how the paper tears before bond failure in the illustration at left.

Schenectady Varnish manufactures a complete line of resins for adhesives. Phenolics, modified-phenolics, terpenes and terpene phenols all are commercially available for use in pressure-sensitive. shoe sole and industrial adhesives. Whatever your adhesive resin requirement, your Schenectady technical representative is ready to help. Why not call him today or write; Schenectady Varnish Company, Inc., Dept. 10, Schenectady, N. Y.

SHOE SOLE ADHESIVES containing Schenectady phenolic resins stand up to hot pavements, have excellent cohesion and adhesion. Tack-free at room temperature toward other materials, they simplify handling, speed production.

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Staley Promotes Two

Wendell D. Ray has been named an industrial sales manager of the A. E. Staley Manufacturing Co., Decatur, Ill., and George M. Donelan has been appointed to succeed him as manager of the firm's Boston office. Mr. Ray, a 1950 graduate of Indiana University, joined Staley in that year as a price and market analyst in industrial sales. He became a senior industrial sales representative in 1952. For the past two years he has been branch manager of the company's Boston office. Mr. Donelan graduated from Boston College in 1947. He has been with Staley for eight years, joining the company in 1951 as a senior industrial sales representative. He has been assistant manager of the company's Cleveland office for the past three years.

Appointed by Catalin

Howard Wood has been named a sales engineer in the Resins Division of Catalin Corp., of America, New York, N.Y., and will cover parts of the New England and Middle Atlantic states from the New York headquarters of Catalin. He is a graduate of Fordham University with a B.S. degree in chemistry.

New Roberts Distributors

The Gulf States Plywood Co., New Orleans, La., and the Orders Tile and Distributing Co. of Greenville and Columbia, S.C., have been named distributors for Anchor-Weld contact bond cement, manufactured by the Roberts Co., City of Industry, Calif. The Gulf States Plywood Co. operates throughout the southern half of Louisiana to the Texas border, and the southern half of Mississippi to the Alabama border. Orders Tile and Distributing Co., Inc., will distribute Anchor-Weld throughout upper South Carolina from the Greenville office, and lower South Carolina from the Columbia office.

A-D-M Income Report

For the nine months ended March 31, Archer-Daniels-Midland Co., Minneapolis, Minn., has reported a net income of $2,265,095, equal to $1.65 per share, as compared to $4,341,823, or $2.70 for the like period in 1959. For the six months ended December 31, net income was $1,971,165, equal to $1.23 a share, compared to $3,089,245, or $1.93 a share in the like period of the preceding year.

Herbert Heads Committee

Paul R. Herbert, president of the Hood Ceramic Corp., Daisy, Tenn., was elected chairman of the Department of Commerce Commodity Standards Committee CS 181-52 at a recent committee organization meeting at the Commerce Building, Washington, D.C. CS 181-52 is the Commercial Standard for Water-Resistant Organic Adhesive for Installation of Ceramic Tile. The committee is elected by vote of the ceramic tile industry, the adhesive industry, and others accepting the commercial standard. C. H. Burchenal, president of the Cambridge Tile Co., Cincinnati, Ohio, was re-elected vice-president; Dr. J. V. Fitzgerald, director of research of the Tile Council of America, secretary; and A. C. Chadwick, president of Permalastic Co., Detroit, Mich., treasurer. A. S. Best, assistant chief of the Commodity Standards Division, was elected recording secretary. Dr. J. V. Fitzgerald has been appointed chairman of a technical sub-committee, composed mainly of industry technicians, to make recommendations to the committee for bringing up-to-date the standard adopted July 12, 1952.

3M Division Names Seven

Seven new appointments have been announced by the Irvington Division of Minnesota Mining & Manufacturing Co., St. Paul, Minn. Erwin W. Brown, former manager of the Plastics Department, has been named manager for electrical products, while Jerry Bolles, formerly sales manager for the Plastics Department, has been named sales manager for OEM electrical products. Frank A. Kelly, who had been sales manager for motor repair trades products of the Coating Department and for electrical industrial trades, has been appointed sales manager for electrical products for motor repair trades. Gordon C. Brown has been appointed manager of special products and W. G. Sweet has been appointed sales manager for special products. Daniel J. MacDonald and Harold Fink have been named to the posts of technical director and production manager, respectively.

Newnan Buys Richardson

Richardson Co., Newnan, Ga., has been purchased by the newly-formed Newnan Corp., manufacturer of high-pressure decorative laminated sheets, at a cost of about $1 million. The company, scheduled to be in operation within a month, will be owned and operated by a group of Southern businessmen.

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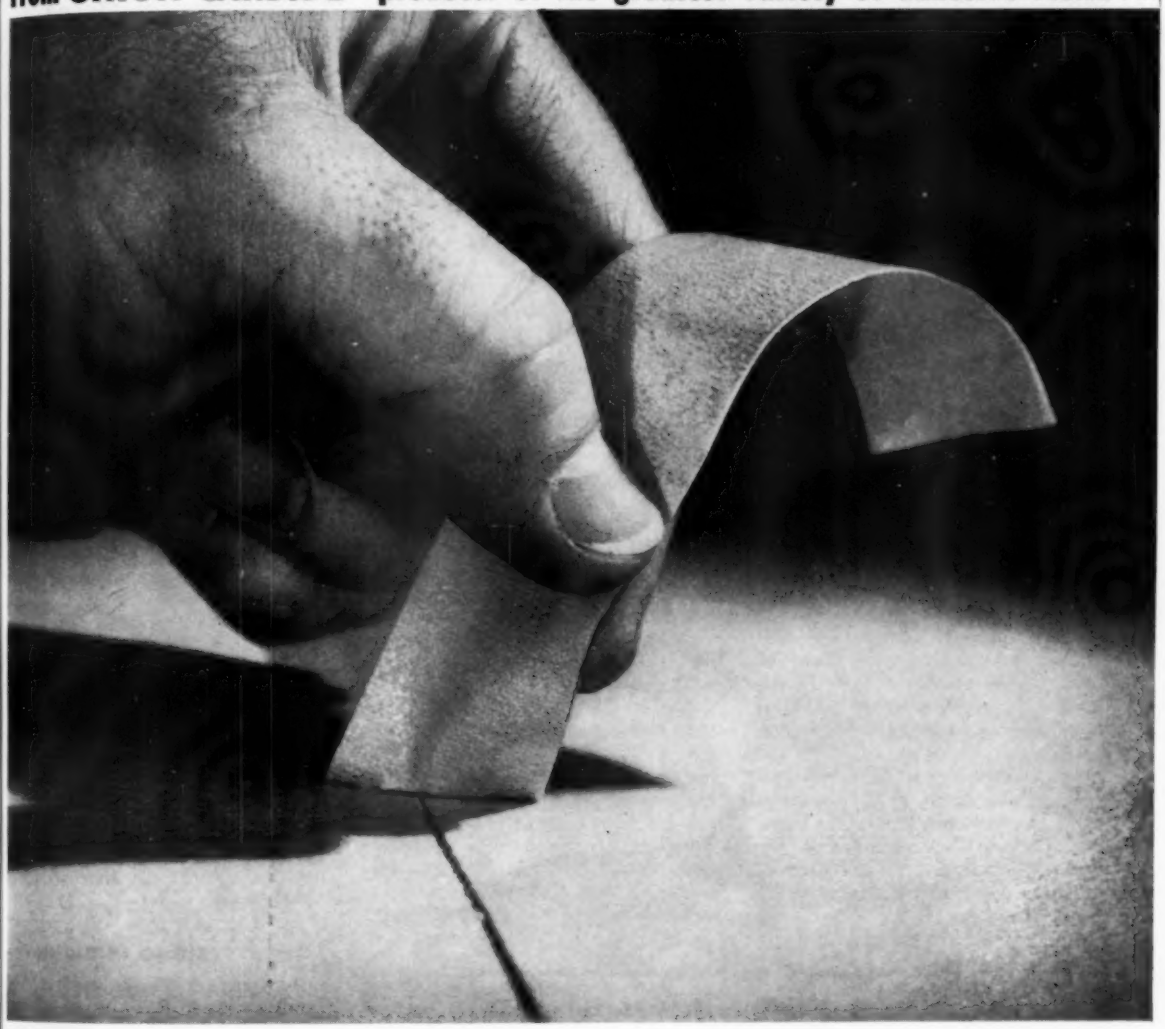

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At the reception following the formal opening and dedication of the expanded vinyl resin plant of Cary Chemicals, are, left to right: Hon. Robert B. Meyner, governor of the State of New Jersey; George F. Blasius, president of Cary Chemicals, Inc.; and Bernard M. Berns, staff editor of ADHESIVES AGE.

Cary Dedicates Facilities

George F. Blasius, president of Cary Chemicals Inc., New Brunswick, N.J., predicted that polyvinyl chloride demand may reach 2 billion pounds per year by 1970, at the April 27 dedication of the company's new addition to its PVC homopolymer and copolymer facilities in Flemington, N.J. Guest speaker at the ceremonies was the Hon. Robert B. Meyner, governor of the State of New Jersey.

In 1957 the Flemington installation went on stream with a rated capacity of 12 million pounds of resin annually. The addition now brings this plant's capacity to 50 million pounds per year. New pilot plants are in operation at both Flemington and East Brunswick. They will permit intensified product development for Cary Blacar products. All company departments, including manufacturing, research and development, sales, financing and warehousing facilities have been widely expanded.

Shawinigan Names Haag

Karl H. Haag has been appointed manager of the Patent Department of Shawinigan Resins Corp., Springfield, Mass. Mr. Haag, who has been patent attorney for the department, will, in his new capacity, continue to direct activities in patent prosecution, licensing, trademarks, and other related areas. He holds a B.S. degree in biochemistry from Queens College and an LL.B. degree from Brooklyn Law School. He joined Shawinigan as patent attorney in 1953. He is a member of the American Chemical Society, the New York State Bar, Patent Office Society, and the American Patent Law Association.

Avery Building Plant

Avery Label Co., Monrovia, Calif. has broken ground for an 18,000 square foot plant in Cleveland, Ohio. The company produces pressure-sensitive labels.

New Marblette Distributor

Marblette Corp., Long Island City, N.Y. has appointed Foss Manufacturing Co., Twin Falls, Idaho, as sales representative in Idaho, Nevada, Utah, and Wyoming, thus expanding Marblette's distribution. The appointment is in line with a company policy of seeking representation by distributors with working knowledge of plastics applications facilitating technical assistance to resin users, as Foss has wide experience in this and allied fields.

National Casein Expands

National Casein Co., Chicago, Ill., has announced that expansion of laboratory facilities at the company's Riverton, N.J. plant is under way. Testing equipment has been increased by 25 per cent, and laboratory personnel is up 50 per cent, the company reports. The expansion is part of a long-range program.

Union-Camp to Merge

Stockholders of Union Bag-Camp Paper Corp., New York, N.Y., approved a proposal to merge Union-Camp with River Raisin Paper Co., Monroe, Mich., at the annual meeting held April 12 in Jersey City, N.J. Stockholders of River Raisin had approved the merger plan late in March. At the Union-Camp meeting the company reported 1960 first quarter sales at a record high with a 10 per cent increase over the like period in 1959. However, rising costs of labor and materials brought about a reduction in first quarter earnings.

The articles of merger provide that five shares of Union-Camp capital stock will be issued for each six shares of River Raisin's capital stock. The surviving company will be Union Bag-Camp Paper Corp., and River Raisin will be operated as a division of the company under its own name, with Arthur J. Goetz, executive vice-president of River Raisin since 1951, heading the division.

Union-Camp's net sales for the first quarter amounted to $47,369,415, up from $43,062,800 for the comparable 1959 period. Net income after provision for taxes was $4,709,496 or 64¢ a share. This compared with $4,894,363, equal to 66¢ per share on the shares presently outstanding, for the same period in 1959.

Horan Named Manager

Lawrence J. Horan has been appointed manager of the West Coast Division of National Starch and Chemical Corp., New York, N.Y. His headquarters will be in San Francisco. Mr. Horan graduated from Illinois Institute of Technology in 1950 with a B.S. degree in chemical engineering. Upon graduation he joined National and served as an adhesives sales representative in Chicago. In 1955 he joined the resin sales group and was soon made supervisor of Midwestern resin sales. He came to New York as sales manager the following year and served three years as manager of National's Southeastern Division.

Opens Portland Plant

New manufacturing and testing facilities for all types of adhesives have been opened by West Coast Adhesives in Portland, Ore. Blood and soya glues for interior and exterior grade plywood, phenolic resin, and urea will be produced.

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names in the news

Bernard Berkeley has been appointed director of the Product Development Department of Foster D. Snell, Inc., New York, N.Y., replacing **Daniel Schoenholz** who has been promoted to another position.

John M. Elder, formerly project chemist, has been named chief chemist at the kraft pulp mill of Weyerhaeuser Co., located in Everett, Wash.

Reid A. Feather, formerly associated with Food Machinery & Chemical Corp., has joined the Chemical Engineering Department of Emery Industries, Cincinnati, Ohio.

Walter P. Krause has been named a supervisor in the Plant and Sales Technical Service Section of Jefferson Chemical, Austin, Tex.

Charles H. Bodamer has joined the staff of the Research Center of Shell Development at Emeryville, Calif.

G. A. Meisinger, a vice-president of Kordell Industries, Mishawaka, Ind., will head a newly formed industrial coating division.

Charles M. Saffer, Jr., has joined Thiokol Chemical Corp., Bristol, Penna., as assistant director of research planning.

Robert Barclay, Jr., Arthur K. Ingberman, George E. Myers, and **Dale F. Pollart,** have been named project scientists at the Research Department of Union Carbide Plastics Co., Bound Brook, N.J.

Robert K. Wagner has been appointed assistant manager of advertising and public relations, and **Paul L. Behers** has been named advertising manager of the Engineering and Construction Division of Koppers Co. Inc., Pittsburgh, Penna.

Dr. M. Frederick Amos, formerly associated with Abitibi Power & Paper, has been named chief research chemist at Le Page's, Inc., Toronto, Canada.

George A. Hudson, a chemist at Mobay Chemical Co., Pittsburgh, Penna., received the firm's annual Research Award for 1959 for work in development of urethane coating systems and polymer modifications.

Allan E. Peyer has joined Archer-Daniels-Midland Co., Minneapolis, Minn., as assistant to the vice-president and director of marketing.

Dr. Milton H. Fisher has joined the Niagara Chemical Division of Food Machinery & Chemical Corp., Middleport, N.Y., as a senior organic chemist. **Dr. Fred C. Swift** has returned to the company from Rutgers University and will work in the field development program.

Ted FitzGerald, formerly with Wornow Process, has been appointed technical sales representative at Specialty Resins Co., Lynwood, Calif.

D. Stewart Quern has been named to the newly-created post of senior sales coordinator for industrial chemicals in the southeastern territory for the Chemical Division of Food Machinery & Chemical Corp., New York, N.Y.

Robert E. Swisher has been appointed vice-president, marketing, at the Alsynite Division of Reichhold Chemicals, Inc., San Diego, Calif.

Dr. E. L. Grove, formerly an associate professor at the University of Alabama School of Chemistry, has been named a research chemist at Armour Research Foundation, Chicago, Ill.

John Delmonte, president and general manager of Furane Plastics Inc., Los Angeles, Calif., has been named "Outstanding Businessman of the Year" by the Los Angeles Chapter of the National Association of Accountants.

Robert E. Glavin, formerly associated with Arthur D. Little, Inc., has been appointed a chemist by Keelox Manufacturing Co., Rochester, N.Y.

Z. J. Obara

Named Research Director

Zdzislaw J. Obara has been appointed director of research of Dicks-Armstrong-Pontius, Inc., and will be located at the firm's research and technical laboratories in Zenia, Ohio. He formerly was assistant technical director for Valspar Paints Co., plant superintendent and vice-president of Crawford Laboratories, and a research group leader for the Glidden Co. Mr. Obara graduated from Kalamazoo University with a degree in organic chemistry and chemical engineering and has done post graduate work at Case Institute and the University of Chicago.

Karl H. Haag has been named manager of the Patent Department at Shawinigan Resins Corp., Springfield, Mass.

Robert C. Clark, formerly a buyer at United Aircraft Corp., has joined Taylor Fibre Co., Norristown, Penna., as a sales engineer in the New England district sales office.

Robert D. Atkins, formerly consulting engineer, Dunphy Associates, Inc., has been named mechanical engineer, Minnesota Mining and Manufacturing Co., St. Paul, Minn.

LeRoy P. Wahl, formerly with Archer-Daniels-Midland Co., has joined General Mills, Inc., Minneapolis, Minn., as a research chemist.

Joseph M. Hentz, John D. Thomson, Patrick B. Gallagher, and **J. Allen Havens** have joined the sales staff of Furane Plastics Inc., Los Angeles, Calif.

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designed to serve as a guide to the types of adhesives available for bonding various materials in various applications. This new British publication covers adhesives used in woodworking, bookbinding, footwear, etc., and offers valuable data on the advantages of adhesive bonding and the classification of adhesives.

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Adhesion Talk Given To Fort Wayne Group

The fourth meeting of the 1959-1960 season of the Fort Wayne Rubber & Plastics Group was held on April 14 at the Van Orman Hotel in Fort Wayne, Ind. The technical program consisted of a talk on "Compounding Elastomers for Rubber-to-Metal Adhesion," by William M. DeCrease (Hughson Chemical). He stated that the introduction of organic adhesives for bonding elastomers to metal resulted in greater freedom for the rubber compounder in a choice of compounding ingredients. Brass plating, he explained, placed some very definite restrictions on the compounder such as the type and amount of sulfur and sulfur-containing vulcanizing agents in order to achieve a proper chemical union between the copper in the brass and the sulfur in the elastomer compound.

According to Mr. DeCrease, some of the major considerations which should be helpful when compounding an elastomer which is to be bonded to metal are: elastomers may be indexed according to the ease with which they are bonded to metal; in copolymer elastomers, the concentration of monomers has a pronounced effect on the adhesion to metal.

Rubba Plastic Sealing

Rubba-Seal, a transparent liquid plastic with adhesion to metal, wood, fabric, cork, leather, and other surfaces, has been developed by Rubba, Incorporated, New York, N.Y. Rubba-Seal makes possible the manufacture of water-tight, leak-proof window flower boxes, ash cans, metal milk boxes, waste paper baskets and other metal boxes and containers fabricated with spot welding only, according to the company. It is easily applied to the seam of the container by means of a brush, spray or flow gun, and is transparent when it dries. It resists acids and alkalies, and comes in one- and five-gallon cans as well as in 55-gallon drums.

Seal-Kap Earnings Up

Consolidated sales and other revenues of American Seal-Kap Corp., New York, N.Y., reached $33,279,951, with earnings of $2,493,439, and net earnings after taxes and provision for minority interests at an all-time high of $1,028,324. Per share earnings, on the average shares outstanding during the year, were $1.41 a common share.

R. A. DeWolfe

Named Product Manager

Robert A. DeWolfe has been appointed product manager for the National Adhesives Division of National Starch and Chemical Corp., New York, N.Y. He will be responsible for all the marketing functions within the division. Mr. De Wolfe will coordinate the work of the division's various technical development groups with the over-all marketing and sales activities, and will have his headquarters at the company's executive offices in New York City. He is a graduate of Wheaton College and joined National Starch in 1946, serving as an adhesives sales representative in northern New Jersey until he was appointed New York sales manager in 1954. He had been manager of National's Pacific Coast Division since 1956.

Reichhold Appoints Feld

Israel Feld has been named manager, technical service, surface coating emulsions, of the Emulsion Division of Reichhold Chemicals, Inc., White Plains, N.Y. He will have responsibility for technical service activities on emulsion coatings for Reichhold customers in this country east of the Rockies. Mr. Feld has his headquarters at the company's Elizabeth, N.J. plant. He holds a B.S. degree in chemistry from Brooklyn College.

Potdevin Names Hamilton

James S. Hamilton, assistant to the president of Potdevin Machine Co., Teterboro, N.J., has been named vice-president of sales for the Bag Machine Division. With the firm for 25 years, Mr. Hamilton has also served as a sales representative and advertising manager.

Northeastern Section Hears Adhesives Talk

"Current Topics in Rubber-to-Metal Bonding," was the subject of a paper given by Stewart L. Brams (Dayton Chemical Products Laboratories) during the April 19 meeting of the Elastomer & Plastics Group, Northeastern Section, ACS, at Morse Auditorium, Museum of Science, Boston, Mass. Seventy persons attended the meeting and heard Mr. Brams discuss the present state of the art and recent developments in metal preparation, testing, and general cement systems in use.

Mr. Brams stated that pre-baking as a means of controlling mold dirtying and cement film flow is definitely advantageous with certain cements which were tested. In addition, stock formulation is an important factor, both regarding adhesion and the effect of stock flow on cement film, movement of film, and dirtying of mold. One general conclusion drawn by the speaker was that good adhesion practice requires the matching of cement and stock for each specific instance cited.

Thermogrip Adhesives

Two new formulations of its cord-like hot melt adhesives have been announced by United Shoe Machinery Corp., Boston, Mass. Thermogrip 308 adhesive has been developed to meet demands for bonding double polyethylene-coated boards, including paper milk carton and folding box production, the company reports. The second formulation, available in 1/4-inch diameter and 3/16-inch diameter, has been developed for foil sealing. The larger size, Thermogrip 309, is designed to appeal to users of larger volume applicators. The smaller size, Thermogrip 409 adhesive, is for the smaller capacity Thermogrip applying systems installed on various types of in-plant carton-closing equipment, the company states.

Potdevin Named Agent

Potdevin Machine Co., Teterboro N.J., has been named United States distributor of Autorex Precision Labeling Machines. Autorex machines, made in adhesive and heat seal models, are a development of Rawsons Ltd., Kent, England. The machines are designed to label glass, metal, plastic, wood, cardboard and composition containers from ½-oz. to 20-oz. sizes.

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RUBBER TO METAL BONDING

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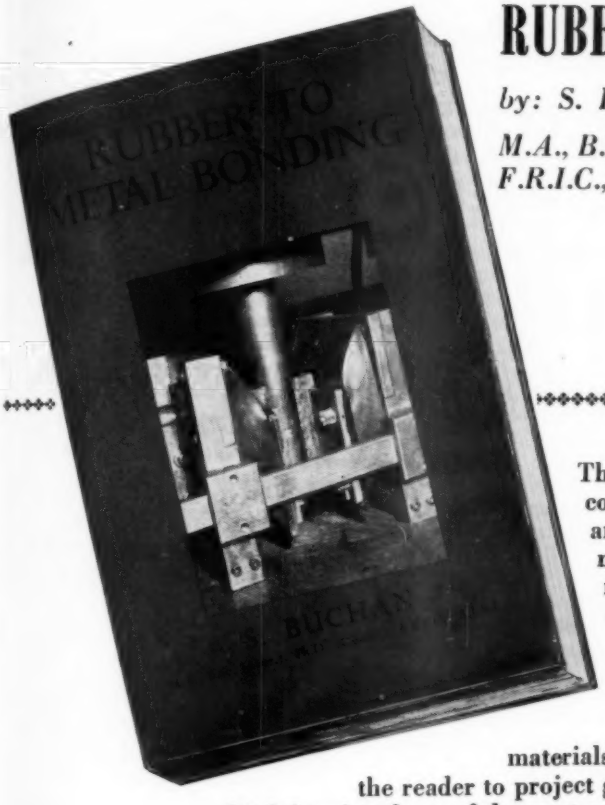

This new edition of Dr. Buchan's important and comprehensive work, has been completely revised and up-dated to include the many advances and new developments in the technology of bonding rubber-to-metal in the 10 years since the publication, in 1948, of the widely-acclaimed original edition. Describes processes, applications and methods in detail. Gives concise, straight-forward explanations of how to handle rubber-to-metal bonds at each stage of the job. Sufficient materials are included with each description to permit the reader to project given examples to his own needs. Written by the chief chemist of one of the most successful bonding firms in the world, this is the single most complete source of information about a subject of major technical importance to men working in the rubber adhesive industries.

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June 1-3. Instrument Society of America, 6th Annual Instrumental Methods of Analysis Symposium, Montreal, Quebec, Canada.

June 3-12. International Trade Fair, Expo Oresund, Helsingborg, Sweden.

June 5-9. American Society of Mechanical Engineers, Annual Meeting and Aviation Conference, Statler Hilton Hotel, Dallas, Texas.

June 5-9. Forests Products Research Society, 14th National Meeting, Montreal, Quebec, Canada.

June 5-9. Society of the Plastics Industry, 9th National Plastics Exposition and Conference, New York, N.Y.

June 5-9. World Power Conference, Madrid, Spain.

June 6-8. American Materials Handling Society, New England Show, Commonwealth Armory, Boston, Mass.

June 6-9. New Coatings and Coatings Raw Materials Symposium, Coatings Technology Department, North Dakota Agricultural College, Fargo, N.D.

June 9-11. Manufacturing Chemists' Association, 88th Annual Meeting, Greenbrier, White Sulphur Springs, West Va.

June 9-11. National Society of Professional Engineers, Statler Hilton Hotel, Boston, Mass.

June 10-26. Federation of British Industries Exhibition, New York Coliseum, New York, N. Y.

June 12-25. Industrial Management Center, 7th Annual Materials Handling and Packaging Training Course, Lake Placid Club, Lake Placid, N.Y.

June 13-15. 43rd Annual Conference and Exhibition of the Chemical Institute of Canada, Chateau Laurier Hotel, Ottawa, Ontario, Canada.

June 14-16. Laminated Foil Manufacturers Association, Annual Outing and Meeting, Hershey Hotel, Hershey, Penna.

June 15-17. Rubber & Plastic Adhesive & Sealants Manufacturers Council, Directors Meeting, Broadmoor Hotel, Colorado Springs, Colo.

June 18-26. Plastics Industries Exhibition, Europlastica 60, Ghent, Belgium.

June 19-22. American Institute of Chemical Engineers, Del Prado Hotel, Mexico City, D.F.

June 20-24. Gordon Research Conferences, Information and Documentation, New Hampton School, New Hampton, N.H.

June 21-30. International Chemical Exhibition, Belgrade, Yugoslavia.

June 24-29. Building Research Institute, Summer Program Planning Meeting, Wianno Club, Wianno, Mass.

June 27-July 3. International Federation of Automatic Control. First Congress, Moscow, USSR.

June 27-July 1. Massachusetts Institute of Technology, Course on Adhesive Joints, Cambridge, Mass.

July 4-8. Sawmilling and Wood Machinery Convention, Olympic Stadium Exhibition Building, Melbourne, Australia.

July 11-15. Gordon Research Conferences, Statistics in Chemistry and Chemical Engineering, New Hampton School, New Hampton, N.H.

July 13-16. Silver Bay Conference on Human Relations in Industry, Silver Bay, New York

Portrait Of

A. M. CREIGHTON, Jr.

While with the OSS in China during World War II, Albert M. Creighton, Jr., often had occasion to see men desperately trying to repair a shot-up gas tank in an urgently needed truck or jeep. He kept thinking of the need for a quick way to make on-the-spot repairs of this type.

After the war, he spent several years working in a crude 8x10 lean-to experimenting with a thousand combinations of steel and epoxy resins. In time he united the two in a process not unlike the homogenization of milk. The result was Plastic Steel and the Devcon Corp., Danvers, Mass., which was founded in 1953.

Mr. Creighton had previously founded, in 1947, the Chemical Development Corp., Danvers, Mass., which set about to develop and market a plastic rubber compound. When the market for the formulation proved insufficient, he obtained from DuPont several projects that they had given up on and completed the research on his own.

Asked what he felt was his chief role as Devcon's top executive, Mr. Creighton replied, "Product development. It's important because in the adhesive field a product may be profitable for only one year, although some specialty materials are still on the increase after ten years."

Mr. Creighton received his B.S. degree in business management from Harvard University in 1942. He is a member of the Society of Plastics Engineers.

Three Named at Borden

Borden Chemical Co., New York, N.Y., has announced three new appointments. Stephen G. Paliska, Sr. has been named an assistant vice-president; John C. Becker, Jr. has been appointed assistant technical service manager for the Polyco-Monomer Department; and Nick Mechales has been named a technical sales representative for the same department.

Mr. Paliska will be responsible for staff and national account sales in the building material industry and will have his offices in New York City. He was formerly assistant general manager of the Coatings and Adhesives Department. He holds a B.S. degree in civil engineering from Lehigh University, and from 1945 to 1956 he was president of the Pioneer Latex and Chemical Co., acquired by Borden Chemical in 1956.

In his new position, Mr. Becker will concentrate on the development of new polymer emulsions and related products for the paint industry. He will be located in Leominster, Mass. Mr. Mechales will be responsible for the sale of Polyco-Monomer's full line of synthetic resins in Illinois, Indiana, Michigan, and Kentucky.

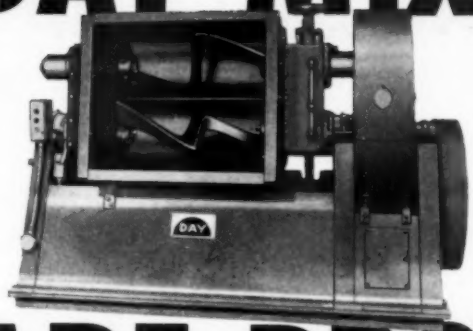
Polystix Adhesive

Polystix, a new pressure-sensitive adhesive for foamed polystyrene and polyethylene, has been developed by Adhesive Products Corp., New York N. Y. When foamed polystyrene or polyethylene is coated with Polystix and allowed to dry, it becomes pressure-sensitive and will adhere, making it possible to stick foamed plastic to almost any surface without applying an adhesive at the time of use, according to the company. With Polystix it is possible to produce self-adhering styrofoam displays and decorations as well as self-adhering foam insulation and self-adhering polyethylene decorative wall coverings. Available in 55-gallon drums and in one- and five-gallon cans, it is applied by brush, spray or roller coater.

Armour Shifts Research

Decentralization of Armour & Co., Alliance, Ohio, has been climaxed by the elimination of the company's central research unit. All research will now be done at the separate divisions. Personnel will be reassigned to four other research labs and pilot plants during the next year. Part of a major reorganization started in 1957, the shift is expected to improve and expand the firm's research with an increase in research activity.

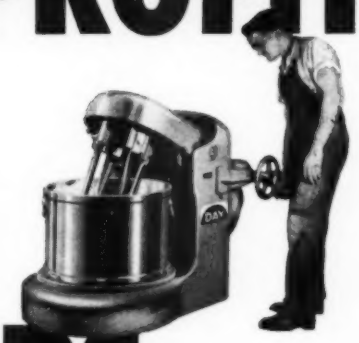
DAY MIXERS



DAY Double Arm Mixers are built in several models with capacities ranging from 1 qt. to 1000 gals.

ARE PROFIT

DAY Change Can Mixers are produced in single and twin-motion models, in sizes from 2 to 125 gal. working capacities.



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patent review

By MELVIN NORD

Treatment of Surfaces to Render Them Adherent

U. S. Patent 2,910,723, issued Nov. 3, 1959 to George W. Traver and assigned to Traver Investments, Inc., describes a method for treating non-adherent surfaces such as plastics, to render them adherent, by means of an electrostatic force field.

An object of the invention is to provide a method by which effective treatment of polyethylene and similar film is brought about for rendering it adherent to inks, etc., while at the same time carrying on the treating operations under conditions which do not produce a corona or form ozone and while also reducing the voltage requirements.

As shown in Figures 1-4, a roll (11) of the plastic material (12) in the form of a film or web, may be mounted in a suitable support frame and guided into and through an electrostatic treatment zone. To this end, the support frame is shown provided with a pair of guide rollers (13), carrying an endless belt (14) of electrical-conducting material. This belt may comprise a fabric base (15), which is desirable to give strength to the structure, and a surface coating (16) of electrical-conducting material adhered upon the outer surface of the fabric base. The film of plastic material (12) may be drawn continuously from the roll (11) and guided around the rollers (13) and upon the conducting surface of the belt (14), the web (12) being thus supported between the rollers (13) upon the upper stretch (17) of the belt (14), which may be, and preferably is, supported between the rollers (13) upon one or more stretch-supporting rollers (18). The stretch-supporting rollers (18) thus enable the web of plastic material (12) to be held in a substantially flat plane. The lower stretch (19), of the belt (14) may travel on a roller (20) which is adjustable in order to tension the belt on the rollers (18) and thus aid in maintaining the upper sheet-supporting stretch (17) thereof in a flat plane.

The electrostatic field may be produced readily and conveniently by the operation of tubular gaseous discharge lamps (21) in the vicinity of the path traversed by the web (12) between the rollers (13). The electrode (24) of each of the lamps (21) may be electrically connected with one side of the secondary winding (27) of a corresponding transformer (28), a separate transformer being provided for energizing each of the lamps. The lamp remote ends of the secondary winding (27) of the several transformers may be interconnected in common and electrically connected with a roller (29) which

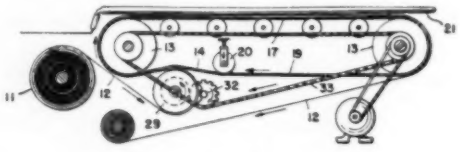


Figure 1

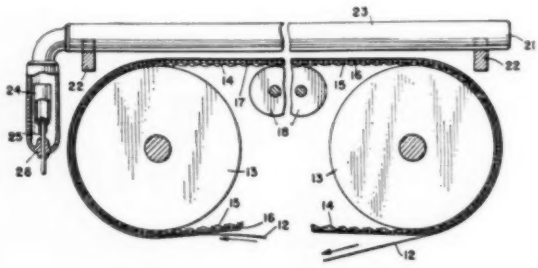


Figure 2

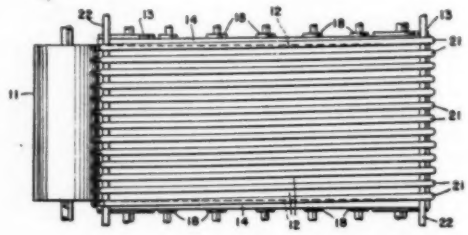


Figure 3

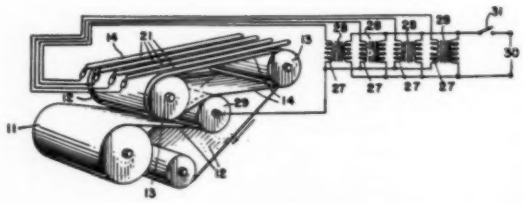


Figure 4

makes electrical contact with the conducting layer (16) of the belt (14). As shown, the roller (29) may form a guide roller for guiding the film web (12) from the roll (11) onto the belt (14). The conducting layer of the belt which extends in the web-supporting stretch (17) will constitute an electrostatic plate extending on the side of the web (12)

As a specific example of the process, the following is set out: A sheet of polyethylene film is carried by the carrier belt (14) below tubes (21) of approximately 40 inches in length and having approximately 37 inches of effective length over the film. The carrier belt is operated at a speed of 100 feet a minute, and the voltage employed in connection with the tubes is approximately 10,000 volts. In the operation, the film is carried under the tubes a second time and the non-adhering character of the exposed surface of the film was found to be changed to a surface highly receptive to inks, pigments, decorative material, floc, adhesives, etc. Any of these added materials would be applied after the treatment described. For example, the film was found to be highly receptive to such materials and adherent thereto even though the treated film had been stored for months after treatment.

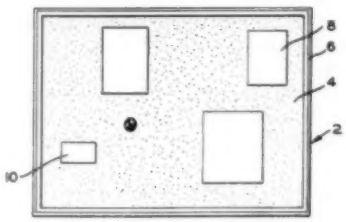
Sulphite Waste Liquor

U. S. Patent 2,923,693, issued Feb. 2, 1960 to Warren A. Lemke and assigned to International Paper Co., describes the preparation of an adhesive from dried sulphite waste liquor and an organic material compatible with it, such as polyacrylamide.

The adhesive is quick-setting, has good cohesive strength in its liquid state, has excellent initial tack, does not become brittle when dried, is not hygroscopic, and spreads readily in gluing operations.

Adhesive Devices

U.S. Patent 2,914,873, issued Dec. 1, 1959 to Andrew Brennan, provides an adhesive sheet having a pressure-sensitive adhesive surface, to which paper or other flat articles may be mounted by simply pressing the article against the adhesive surface. The article may later be removed without damage by just pulling it off.



As shown above, the display board *(2)* has a pressure-senstive adhesive surface *(4)* protected at its edges by the surrounding frame *(6)*. On the display board, sheets of paper *(8)* and a card *(10)* have been mounted in the manner described.

Structural Adhesives

U. S. Patent 2,920,990, issued Jan. 12, 1960 to Jerome L. Been and Martin M. Grover, assigned to Rubber & Asbestos Corp., provides structural adhesives having high bond, peel, and impact strength, and which are solvent-resistant. These new materials form excellent metal-to-metal bonds, and can be used to formulate structural adhesives having sufficient strength and weathering properties to join metal skins to the metal honeycomb cores used in airplane fabrication. They may also be used in electrical "printed circuits".

The three basic components consist of (1) a fusible phenolaldehyde resin, (2) a polyepoxide resin, and (3) a butadiene-acrylonitrile copolymer or a polyvinyl-acetal having between 2 and 25 per cent residual hydroxyl groups.

Other Patents of Interest

Subject	Inventor or Assignee	Patent No.	Date
Paper coating composition	Secretary of Commerce	2,920,984	1/12/60
Tape dispenser	Federal Tool Corp.	2,921,493	1/19/60
Tape dispensing package	Chicago Carton Co.	2,921,674	1/19/60
Machine for taping objects on cards	Warren J. Habgood	2,922,265 2,922,729	1/26/60 1/26/60
Improving the bonding properties of steel surfaces	Food Machinery & Chemical Corp.	2,923,608	2/2/60
Animal glue treated with a tanning agent	Swift & Co.	2,923,691	2/2/60
Starch ether	A. E. Staley Mfg. Co.	2,923,707	2/2/60

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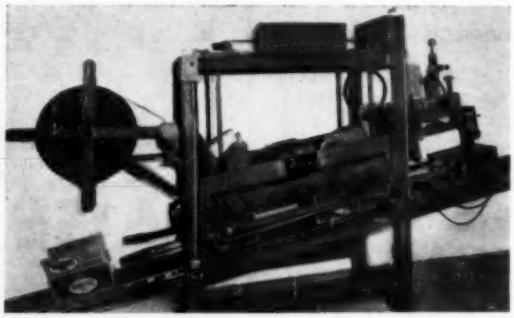
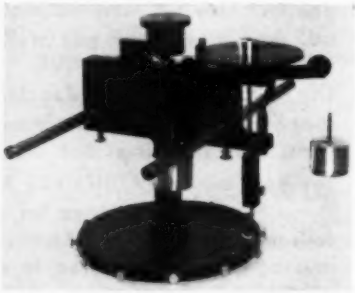
Case Sealer-Taper

Designated Model TS-10, this automatic case sealer-taper applies gummed tape to join the top flaps of filled corrugated paper containers, and rolls the extended ends of tape over and onto the end panels for complete single-strip sealing. The unit performs while the cases travel up-hill at an 8 degree inclined angle, a factor when the sealer is located in tight quarters. Height adjustment can be motorized. The machine is 7 feet 6 inches in length, excluding over-hanging tape cage. Standard width of the unit is 3 feet. Model TS-10 has a capacity for sealing 30 cases per minute. It can be added to the end of the compression section of an existing glue-sealer, to provide flexibility for gluing only; for taping only; or for both gluing and taping progressively. The machine can be equipped to apply tear-band simultaneously in one operation down the middle of the sealing tape. *General Corrugated Machinery Co.* **E-191**



Multi Torsion Tester

A redesign of Model CS-100 torsion tester, the new unit has increased its capacity from a single sample to 12 samples. According to the manufacturer, the purpose of the unit is for determining the stiffness of nonrigid plastics over a wide temperature range. The Multi Torsional Tester is said to be capable of exerting a torque of approximately 0.1 to 1.0 in/lb on a test sample with a span of 1.5 inches. *Custom* 750°F. *R. C. Mahon Co.* **E-192**

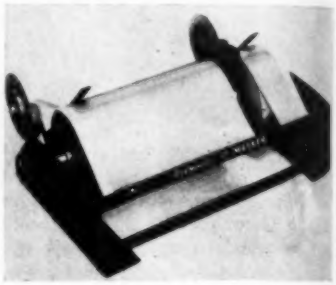


Process Refractometer

Designed for continuous measurement and control of organic and inorganic liquids, the M-S-A Process Refractometer can be readily converted in the field from one problem to another; or from one range to another of the same substance. Readings can be obtained of 90 per cent full scale deflection within 30 to 60 seconds. The unit can be used in production or research to control either stream or batch processes; measure and control product quality; and solve a variety of problems requiring rapid, accurate determinations. The M-S-A Process Refractometer depends on the refraction of light passing through two materials which may have different refractive indexes. It detects and measures the change in light bending due to a variation in refractive index of a sample relative to a constant standard. This variation is detected by a cadmium sulphide photo-cell circuit. *Scientific Instruments, Inc.* **E-193**

Compact Masker

Designed for use in auto repainting and commercial masking operation in spray and roller painting work, the Permacel 10 Portable Masker can accommodate a single 18 inch roll of masking paper or any combination of rolls through 15 inches. The unit has a steel frame with a base area of less than two square feet. Equipped with suction grips for secure anchorage, the Permacel 10 can be bench or wall mounted and is also designed to be carried easily from job to job. The addition of a Permacel 101 Masker Conversion Kit enables the user to dispense a double taped apron or two rolls of masking paper from one machine. *Permacel.* **E-194**



Nylon Strainers

Designed for use in the adhesives, paint, varnish, ink, cosmetics, pharmaceuticals, textile, food processing and coatings industries, Fast-Flow all-nylon strainers are said to be non-clogging and give 3 to 4 times as much straining area as conventional strainers. They can be used with gravity or pumping systems, and large production batches can be run through without hold-up for cleaning. The Fast-Flo strainers can be made in any size or shape to order, and they are easily cleaned and can be re-used indefinitely, the manufacturer states. *Fast-Flo Corp.* **E-195**

Industrial Oven

A special vertical, 45-foot tall industrial oven has been designed by the manufacturer for drying plastic coated fabrics of all kinds, including those employed as nose cones for missiles. The unit, referred to as a tower coater, is wide enough to coat rolls of fabric 72 inches wide, with the coated materials being processed through two zones of the oven, one operating at 400° and the other at *Mine Safety Appliances Co.* **E-196**

Edge Gluing Press

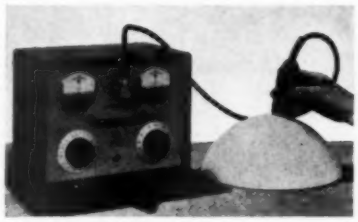
A high frequency edge gluing press, the Pye gluer is said to quickly and efficiently edge bond random width boards. With an average number of glue lines, assembly time is about the same as the curing time.

The maximum length of board usable in the standard press is 6 feet 1 inch by 3 feet in width and a thickness variation from ¾ inch to 1½ inches. Sufficient side pressure is provided to insure that the glued-up panel is flat when removed from the press. Lay-up is carried out on an aluminum covered table attached to the press. An adjustable back stop is used when only narrow boards are being made. Automatic loading and unloading devices are available, as are presses in various sizes to suit requirements. The unit was designed by Pye, Ltd., Cambridge, England. *N. Thackaberry, Inc.*

E-197

Analyzer Probes

New probes are available for use with Model 168, D-K Analyzer, which are said to make possible non-destructive examination of many finished parts made of glass reinforced plastics and other insulating materials. The D-K Analyzer is a direct reading instrument which measures the dielectric constant and dissipation factor of insulating materials. According to the manufacturer, the need for sample preparation is eliminated since the probe can be placed directly on the surface of the part being tested. This arrangement also facilitates rapid uniformity



checks on large structures and sheets of insulating materials. Probes for examining spherically shaped surfaces are available on special order and are made to fit the surface curvature specified. Cylindrically curved probes are also available for use in inspecting the uniformity of solid rod or tubular insulating materials used for coil forms. The D-K Analyzer is normally supplied with a flat probe for use with solid flat insulating materials. A liquid probe is also available for measurements on insulating oils, liquid resins and many other non-conductive organic liquids. *Delsen Corp.* *E-198*

Adhesive Meter-Mixer

Model SP1558 automatic shot meter-mixer is designed for metering, mixing and dispensing two part compounds and adhesives. The adjustment for size of shot, manual or automatic operation and dispensing frequency in automatic use is easily accomplished by means of simple levers and scales. Selectivity of shot size ranges from 1 to 50 grams. The shot meter can handle any type of flowable catalytic, chemical or thermal two-part material. Heated, agitated or pressurized tanks are available to meet compound type requirements. The unit weighs 90 pounds. *Pyles Industries, Inc.* *E-199*

SEALANT EQUIPMENT

nozzles, cartridges guns and mixers

Patent No. 2,838,210

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book reviews

Rubber to Metal Bonding. ***By S. Buchan. Published by Crosby Lockwood & Sons Ltd., London, England. Distributed in U.S. by Palmerton Publishing Co., Inc., 101 West 31st Street, New York 1, N.Y. 5½ x 8½ in. 296 pp. $7.50.***

There is probably no phase of rubber technology that is so much more art than science than that dealing with the bonding of rubber to metallic surfaces. No one is more concerned about this than S. Buchan.

In the first edition of his book published in 1948, Dr. Buchan succeeded admirably in introducing some order into this rapidly growing segment of the rubber industry. However, during the past decade, many new techniques have been developed, so that a second revised edition of this excellent work is welcome indeed. The author's task has not been an easy one. Despite the considerable amount of research and development work that has been carried out on bonding, little of this has been published. It is significant that there are only about sixty more references in the bibliography in the 1959 edition than in the 1948 publication, and most of these are bulletins put out by the manufacturers of new proprietary bonding agents. Therefore, the various theories that are advanced lack the certainty and balance that can only be obtained by assimilating results and conclusions from a variety of sources.

The chapters dealing with the brass plating technique, which constitute one-half of the book, have been reorganized to present a very thorough and comprehensive treatise on the subject. It is obvious that the author knows this technique exceedingly well and deals with it in a very straightforward manner. Those chapters covering chemical bonding agents have been greatly expanded in this revised edition, and over fifty pages of new material have been added. It is unfortunate that much of this information had to be obtained from manufacturers' bulletins and could only be discussed in general terms. A chapter on the testing of bonded units has been added but, while this subject is treated quite thoroughly in view of present day knowledge, the author's conclusions emphasize the need for better correlation between laboratory results and service life.

Drawing on his extensive experience in the field of bonding rubber to metal, the author has produced a very comprehensive, authoritative, and at the same time readable, book. It is well organized and indexed, and the numerous illustrations add much to the text. It is the sort of book that will inform the first time it is read, and will continue to be a great asset as a reference in time to come. It is strongly recommended to both the chemist and the engineer concerned in any way with bonded rubber-metal units. F.W.G.

Polyester Resins. ***By John R. Lawrence. Published by Reinhold Publishing Corp., 430 Park Avenue, New York 16, N.Y. 5 x 7½ in. 251 pp. $5.75.***

Commercially produced polyester resins are about to become of age—literally. Developed in 1942 to replace glass-reinforced laminates in protective shields for Air Corps self-sealing gas tanks, they survived the wartime boom and postwar recession to reach a record production of 160 million pounds last year. By 1965 output may climb to 250 million, a remarkable prospect for a product just outgrowing its "adolescence."

Mr. Lawrence, a product manager for the Glidden Co., has managed to compress the history and prospects of polyester resins into the brief compass of this handbook, the fifteenth in Reinhold's plastics application series. His achievement is all the more remarkable in that he covers virtually all aspects: from chemistry, curing mechanisms and manufacturing, to techniques used in processing the resins for reinforced plastics, casting and coating applications. The last-mentioned is of special topical importance to recent research on air-drying systems.

Couched in semi-technical language, the text should serve as an ideal introduction to these versatile materials for students, designers and manufacturers of plastics. Readers of this journal will be especially interested in references to binders, cements and sealing compounds.

Heatsealing and High-Frequency Welding of Plastics. ***By Hans P. Zade. Published by Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N.Y. 5½ x 8½ in. 211 pp. $5.75.***

The two topics of this title have received scant attention in technical literature, much to the regret of plastics engineers who have had to rely on occasional articles and one book published 14 years ago. That classic, "Welding of Plastics," has now been completely rewritten by one of its co-authors, an international authority on thermoplastics and the holder of several patents in the field.

It is a pleasure to note that the new treatment is as readable as it is comprehensive, making adequate provision for a review of the latest advances in heatsealing. A patent index and a glossary of trade names have been added to render this review of worldwide developments particularly useful for the selection of materials tailored to specific needs. Photographs of equipment and products were obtained from numerous firms to illustrate typical processes. Nearly all of the materials mentioned are relevant to adhesives, making this a valuable compendium for anyone in the industry.

Trade Literature

Polymer Directory and Catalog. Intended primarily for research and professional use, this new revised 12-page polymer directory and catalog lists properties, end uses, and other technical data such as per cent solids, viscosity, pH, particle size, per cent free monomer, specific gravity, and weight per gallon for more than 150 of the company's chemical polymers. Products covered include polyvinyl acetate homopolymer emulsions; copolymer solutions and bead resins; butadiene-styrene emulsions; acrylic emulsions and solutions; polystyrene emulsions; vinyl and vinylidene chloride emulsions; polyvinyl alcohol; sodium polyacrylate thickeners; methyl acetate solvents; specialty monomers; and acrylic rubbers. The directory also provides a complete listing of the company's Polyco-Monomer Department sales offices and plants throughout the United States. *Borden Chemical Co.* L-228

Teflon Coating. Described in this four-page folder are the properties and successful applications for Teflon coating of metal and ceramic tools and parts to contribute anti-sticking or chemically resistant properties. Typical Teflon coating applications are illustrated and the process and limitations of the coating technique are described. The properties of Teflon in solid and in coating form are compared. *Cadillac Plastic & Chemical Co.* L-229

Vinyl and Styrene Resins. New physical forms of both vinyl and styrene resins is the subject of a new technical bulletin entitled, "Bakelite Brand Fibrous Resins as Non-Woven Textile Binder." The bulletin discusses the economical possibilities offered by these materials in the production of denser types of non-wovens. *Union Carbide Plastics Co.* L-230

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- **Adhesive Bonding of Metals—G. Epstein. $2.95.** Considers adhesives used with metals, indicating when an adhesive-bonded joint is advantageous; the type adhesive to use; how to use it, and how to design the joint for optimum performance. ☐

- **Adhesive Bonding of Reinforced Plastics—H. A. Perry. $8.75.** Survey of the design and assembly of structures and products, particularly glass-fiber-reinforced plastic products, by means of adhesives. Gives data on equipment and methods used to produce adhesive bonded joints. ☐

- **Adhesion and Adhesives—N. A. De Bruyne and R. Houwink. $13.50.** A collection of information on the scientific and technological aspects of adhesion. Part I deals with theory, while Part II is devoted to the technology of adhesion. ☐

- **Epoxy Resins—Their Applications and Technology—H. Lee and K. Neville. $8.00.** Guide to the field of epoxy resins, covering the chemistry of their preparation and applications, including a section on adhesives. ☐

- **Polyamide Resins—Donald E. Floyd. $4.50.** Discusses in detail various important applications of the polymers belonging to the polyamide resin family and includes a comprehensive section on adhesives. ☐

- **Principles of High Polymer Theory and Practice —A. X. Schmidt and C. A. Marlies. $13.50.** Study of the principles of high-polymer theory and practice, with a section on adhesives, their applications, and mechanisms and factors involved. ☐

- **Recent Advances in Gelatine and Glue Research —G. Stainsby (Editor). $12.00.** Study of Collagen, and its protein gelatine, comprising papers and Proceedings of an International Conference of the British Gelatine and Glue Research Association. ☐

- **Vinyl Resins—Mayo Smith. $5.75.** Surveys applications of vinyl resins with information on their types, properties, chemistry, manufacture and fabrication. Includes information on several types of adhesives in this category. ☐

- **Epoxy Resins—Irving Skeist. $5.50.** A chapter on adhesives is included in this complete study of the entire field of epoxy resins. The author gives formulations, trade names, methods of manufacture and applications. ☐

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Structural Sandwich Design Criteria. A 16-page report which presents design criteria for structural sandwich constructions under various types of loadings. Included are a brief historical background, a discussion of what constitutes a structural sandwich construction, and basic design philosophy. Detailed design procedures are presented for determining deflections of sandwich beams or panels and buckling of sandwich columns and simply supported panels under edge load, including formulas for calculating facing stresses and core shear stresses. Methods of test for evaluating certain material properties are discussed briefly and modes of failure of sandwich under various loadings are illustrated. *U.S. Forest Products Laboratory.* **L-231**

High-Strength Adhesive. Bulletin No. R-103, a 12-page brochure, presents application data, physical properties, heat and chemical resistance, and tensile properties of bonds made with Eastman 910 Adhesive. Included are five tables: Time for Eastman 910 Adhesive Bond to Set; Tensile Properties of Metal-to-Metal Bonds; Temperature Resistance of Eastman 910 Adhesive Bonds (Steel-to-Steel Bonds); Chemical Resistance of Eastman 910 Adhesive Bonds; and Chemical Resistance When Bonded to Various Materials. *Eastman Chemical Products, Inc.* **L-232**

Printed Circuit Reference Chart. A six page table which includes all of the pre-cut shapes and sizes of pressure-sensitive drafting aids required to make paste-up printed circuit drawings that will conform to military specifications, together with many new non-military configurations. Illustrations are provided in a convenient chart form for easy cross reference between corresponding donut pad, teardrop pad and twin pad sizes. Fully described are the purposes of the several kinds of tape used for making printed circuit drafting aids; black photographic, white, black on white and translucent red. *By-Buk Co.* **L-233**

Epoxy Molding Compounds. A fact file that covers the physical, electrical and chemical properties of the manufacturer's line of epoxy molding compounds. Molding characteristics of the compounds are outlined and detailed product data are given. A number of charts show the physical, electrical and chemical resistance properties of the materials. *American-Marietta Co.* **L-234**

Proportioning Pump. A proportioning pump for chemical feed, metering, testing and process additives is covered in a four-page brochure, Bulletin No. 17A. Pump specifications are given as well as engineering data. *Walter H. Eagan Co., Inc.* **L-235**

Pressure-Sensitive Products Manual. An 82-page booklet, the manual gives data and specifications on the manufacturers tapes, adhesives, coatings and other pressure-sensitive products. A section of the manual is devoted to pressure-sensitive products, adhesives and coatings for industry. This section is broken down into four parts: by armed forces specification data; by tape type; by tape function; and by industrial application. Another section deals with paper, masking, protective, packaging and general purpose tapes, as well as bulk adhesives for industry. *Mystik Adhesive Products, Inc.* **L-236**

Photo-Electric Materials Handling. A unique photo-electric package sorting and merging system is described in this literature. Also described is the application of measuring controls on conveyor lines. The literature also covers a related installation of photo-electric instruments used as a sorting control from a common multiple feed conveyor to individual conveyors leading to separate storage areas. *Photomation, Inc.* **L-237**

Industrial Adhesives. A 10-page illustrated brochure, "Dutch Brand Adhesives" briefly describes the firm's line of elastomeric adhesives for bonding a number of materials. Also shown are the company's facilities. *Johns-Manville Sales Corp.* **L-238**

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in passing

Replacing the Boss

Business Week reports that a two-day symposium conducted by the Carnegie Tech Graduate School of Industrial Administration a short time ago, explored the changes that may happen to management and corporations as far ahead as 1985, even exceeding George Orwell, as one participant put it. The liveliest discussion centered on the prospect of corporations being managed by machines. Carnegie's Professor Herbert A. Simon advanced the idea that many management functions would be programmed and performed by computers—other panelists said he was doing away entirely with middle management. There was much disagreement as to whether machines could do the job in such areas as personnel relations and capital investment. As Dean G. L. Bach explained it, the purpose of the symposium was to try to forsee what lies ahead in the corporate society during the next quarter century and what the implications are for business education. This ties in with the Carnegie Tech School's stress on developing fresh approaches to the teaching problem and avoiding narrow specialization.

June is Bustin' Out

June may be the month for marriage, so it seems strange to discover that Old Maid's Day is observed on June 4. However, to get back on an even keel, we observe National Expectant Fathers' Day on June 18 and Fathers' Day on June 19. Other June observances are: 1-7, National Circus Week; 1-8, National Homemakers' Week; 1-30, National Recreation Month; 12, Children's Day; 12-18, Fraternal Week; 14, Flag Day; 19-26, National Bow Tie Week; and 21-27, National Humor Week.

Madison Avenue

Our friends at *Printers' Ink* report: George Washington to Betsy Ross on being presented with the first American flag—"I don't know, Betsy. Let's run it up the flagpole and see if anyone salutes it." And then there is a new Swiss invention being advertised for the heavy smoker who wants to cut down: a time-lock cigarette case that cannot be opened until the time set by the smoker elapses. Our only question: How does it prevent "bumming?"

And This One

Harry, who made it a practice to visit the bars on his way home from work, was late as usual for dinner. But this time his wife decided to go fetch him. Finally finding him in a bar near his office, she climbed up on a stool and told the bartender: "I'll have the same as his." The bartender returned with a slug of rye. She gulped it and her face turned purple, "How can you," she gurgled incredulously, "drink that awful stuff?" "See sweetheart," replied her husband. "And all these years you thought I was having a good time." . . .

Or the one about the stenographer making a collection for a companion who was about to enter matrimony. She approached one of the male clerks and said, "We're going to give the bride a shower." "Count me in," exclaimed the clerk, "I'll bring the soap."

Have a Billion?

It's hard to appreciate just what a billion dollars is. Here is one way to relate it in simple terms: If you stood beside a well, and dropped a silver dollar into it every second, and you continued to drop a silver dollar into the well every second of every minute, and you never stopped to sleep or eat and just dropped silver dollars into the well with each tick of the clock—it would take you 32 years to use up a billion dollars.

Hot Under the Collar?

Weather forecasters in the future may be telling you, in addition to what climatic conditions to expect, how well you will be able to work during the ensuing 24 hours and what your chances are of having an accident. A study at Blaw-Knox Company's East Chicago Works has shown that when the barometer falls, so does a person's work output. Conversely, proneness to accidents rises. High humidity also impairs a person's ability to produce.

See What We Mean?

A Wyoming janitor probably won't use as much elbow grease when scrubbing windows in the future. After cleaning all the windows of the State House, he saw some boys playing on the grounds outside. He thrust his head out the window to tell them to leave and discovered that the window wasn't open. The glass was too clear to see.